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# Great Oasis settlement pattern in central Iowa

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Great Oasis settlement pattern in central Iowa

by

Don Aden Wirth

A thesis submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of  
MASTER OF ARTS

Major: Anthropology  
Major Professor: Joseph A. Tiffany

Iowa State University

Ames, Iowa

1999

Graduate College  
Iowa State University

This is to certify that the Master's thesis of

Don Aden Wirth

has met the thesis requirements of Iowa State University

— Signatures have been redacted for privacy —

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DEDICATION

This thesis is dedicated in love and friendship to my spouse, Danielle,  
and son, Max.

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## CHAPTER 1. INTRODUCTION

The purpose of this thesis will be to address unresolved issues concerning the settlement patterns of the Great Oasis culture in central Iowa.

Gordon R. Willey was the first researcher to use the term "settlement patterns." His quote (1956:1) places this thesis into perspective in which "settlements are a more direct reflection of social and economic activities than are most other aspects of material culture available to the archeologist."

Authors such as Benn (1985, 1986), Doershuk and Finney (1996), Gradwohl (1974, 1978), Henning (1968, 1971, 1982), Johnson (1969), Johnston (1967), Mead (1981), and Wilford (1945) have given localized descriptions of Great Oasis culture settlement patterns, but their work lacks a unifying cohesion. This is especially true for the Great Oasis culture in central Iowa. This apparent lack of cohesion is partially due to the small amount of research completed on the Great Oasis culture when compared to other prehistoric people and protohistoric cultures regionally such as Middle and Late Woodland, Mill Creek, and Oneota. This thesis will model Great Oasis settlement by following a multidisciplinary approach. The categories of environmental modeling, local and regional site reviews, literature reviews, and the study of diagnostic Great Oasis artifacts will be completed to characterize the settlement modes of the Great Oasis culture in central Iowa. The intent of this study is to identify key environmental resources and variables and integrate these findings to the settlement

pattern model of the Great Oasis culture. Gordon Willey and Philip Phillips (1967:18-19) define a *locality* as a "single community or local group." They go on to explain a locality may be as small as a single site or as large as a "district of uncertain dimensions" and a "geographical space small enough to permit the working assumption of complete cultural homogeneity at a given time." This study addresses site locations in two separate localities in central Iowa, and proposes a third hypothetical locality.

The Noah's Bottom locality is in the Des Moines Valley in north central Boone County, west and southwest of the city of Boone, Iowa. The northern-most site is Logansport (13BN103). The locality continues south for approximately 16 kilometers (9.8 miles) by linear measurement to the Hubby site (13BN38). The Lower South Raccoon River valley locality is in southern Dallas County and begins at the Maxwell site (13DA264) near Redfield, Iowa, and runs along the south Raccoon River to its confluence with the North Raccoon River at the Landis site (13DA12). This locality is approximately 19 kilometers (11.7 miles) in length when measured linearly. The third hypothetical locality is represented by a single site, the West Des Moines burial (13PK38) in southern Polk County, Iowa, near the confluence of Walnut Creek and the Raccoon river. This area has been named the Walnut Creek locality. Since only one site is represented, the size parameters of the hypothetical Walnut Creek locality are not specified.

The sites are referred to by common names and the Smithsonian trinomial system. In the latter, the first series of digits refers to the state in which the site is located. In this study, 13 refers to Iowa. The two capitalized letters indicate the county in which the site lies. Boone County, Dallas County, and Polk County are referred to as BN, DA, and PK,

respectively. The final digits refer to the site number within the respective county.

### Research Questions

The following research questions are addressed in order to interpret the settlement pattern of the Great Oasis culture in central Iowa based on current site and material culture distribution:

1. Are there predictable landforms on which sites with Great Oasis components (habitation and burial) are located?
2. What is the amount of potentially tillable land (using hypothesized Great Oasis horticultural techniques) within 1 kilometer of Great Oasis sites?
  - a. Are there predictable soil types at or adjacent to Great Oasis sites?
3. Is there a predictable spatial factor among Great Oasis sites?
4. What is the current estimated carrying capacity for white-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) in the Noah's Bottom and Lower South Raccoon River localities in central Iowa?
  - a. How do these theoretical cervid populations correlate with theoretical Great Oasis populations?
5. What are the population minimums and maximums of Great Oasis people in the study area and in each locality?
  - a. Were there sufficient resources for the Great Oasis sites to be inhabited contemporaneously?
6. Can a predictive model be developed and tested with extant archaeological and site data (e.g., house types, terrace habitation zones,

river bottom planting, floral and faunal inventories, lithics, ceramics, upland mortuary practices, etc.) for Great Oasis settlements?

#### Limitations

This study addresses why a certain prehistoric people chose to live in certain locations and for what reasons. Since many of the reasons the Great Oasis people chose where to live may be based on oral tradition and other sociological factors, the total picture of their rationale for a particular settlement system will probably never be known. The researcher must focus on recoverable data from controlled surface and subsurface surveys, the geological record, environmental interpretation, and to a lesser extent through historically documented ethnographic parallels. All of the mentioned disciplines are open to interpretation. There is seldom unanimity of thought.

As noted elsewhere in this study, the temporal aspects of the Great Oasis culture are not defined conclusively by radiocarbon dating. The precise times of the Great Oasis occupation of the Noah's Bottom and Lower South Raccoon River Valley localities are not known. The Great Oasis occupation could have been a brief occupation of a single generation or span approximately 150 years based on radiometric data alone.

It is probable that some Great Oasis component sites have not been identified. The Noah's Bottom locality has been extensively surveyed, yet not completely. The Lower South Raccoon River Valley locality has been surveyed at the confluence of the South and Middle Raccoon Rivers, yet a rather lengthy section of the South Raccoon River between the Harmon College Site (113DA107) and the Landis Site (13DA12) (approximately 11 linear kilometers) has no confirmed Great Oasis site. In this section of

the South Raccoon River, there appears to have been ample resources for Great Oasis occupation. Stephen C. Lensink (personal communication, 20 July 1999) contends in the Lower South Raccoon River Valley locality only about 30% of Great Oasis components have been identified. Due to the meandering of the Des Moines and Raccoon Rivers, some Great Oasis components may have been completely washed away. This was nearly the case at the Maxwell Site (13DA264). The modern alluvium of the Camp Creek member of the DeForest Formation may have covered Great Oasis components with alluvium, making productive surface surveys in the future nearly futile without deep testing. The habitation zones associated with the West Des Moines Burial (13PK38) have yet to be located and may never be found due to urban expansion. It is also probable that some site identified by others, but not confirmed for the purposes of this study, may in fact be a Great Oasis component. Examples include 13DA33 and 13DA40 among others.

One of the parameters in the spatial analysis of Great Oasis site locational behavior is the distance to the nearest navigable stream. Due to river meandering, the exact location and course of the Des Moines and Raccoon Rivers at the time of Great Oasis occupation is not known. In general these rivers are restricted by Wisconsinan and Pre-Wisconsinan landforms so the amount of variation in the last 1,000 years is not great.

The designation of a "site" is arbitrary. In this study, nearly all of the sites with diagnostic Great Oasis artifacts have additional Archaic, Middle and Late Woodland, and historic artifacts found at the same location. These components of course pre- or post-date Great Oasis occupation. Therefore, when the sites are officially mapped by the Office of the State Archaeologist, they include all cultural components believed

to be present. The Great Oasis component of a given site may be restricted to a small portion of that site. When pedestrian surface surveys are made, precise provenience of diagnostic Great Oasis artifacts is seldom provided. In the case of the Windmill Village site (13DA112) and the Keufner Site (13DA126), a modern road bisects the two mapped sites. These may actually be only a single site of the same Great Oasis component with two separate "site" designations. A similar set of circumstances exists in the Noah's Bottom Locality where Meehan-Schell (13BN110) and Noah Creek Kiln (13BN111) may be a single site as well as 13BN113 and 13BN114.

Ethnographic parallels given in this research are open to much interpretation. The dimension of the impact of Euro-American intrusion on Native American cultures may skew the relevancy of the parallel to be drawn. The accuracy of some chroniclers is questionable.

The model for environmental conditions circa AD 1000 is at best speculative. As Bryson (1974:759) contends, minor shifts in climatic patterns can have extensive effects on localized weather. Weather patterns could change that would be adverse to Great Oasis horticulture but not significant enough to affect the local native vegetation that might appear in the archaeological record. The faunal analysis is based on modern population models and historic records. It can only be assumed that the earliest historical faunal and floral records were accurate and they approximate the environmental conditions during Great Oasis occupation. The current estimated carrying capacity for white-tailed deer in the study area is based on recent deer census figures. These figures have been viewed conservatively in order to approximate the density of deer during the Great

Oasis occupation of the study area. The faunal inventory available to the Great Oasis people is not well represented by archaeological data.

### Chapter Summary

Chapter 1 introduces this thesis and gives its relevance to the questions of Great Oasis Culture settlement patterns. In Chapter 1 the research questions and limitations of the modeling process are listed.

In Chapter 2 the theoretical orientation of site-catchment analysis is presented.

In Chapter 3 the methods and analytic procedures of this thesis are defined. How Great Oasis sites were determined and verified for this study is given. The five-level "Great Oasis Index Test" (GOIT) is explained as an aid to verification. This is followed by an explanations in mapping, soil analysis, and spatial analysis (the proximity of sites to bodies of water and to one another).

The reader will find an overview of the Great Oasis culture in Chapter 4. This is presented in a regional format.

Chapter 5 discusses the environmental setting in the study area. This includes landforms, and the probable climate, vegetation, and fauna of the study area during Great Oasis occupation.

In Chapter 6 a site-by-site review is presented for confirmed, probable, and possible Great Oasis sites in the study area, as well as those sites that could not be confirmed.

Chapter 7 presents a more detailed description of soil types found within or nearby the 1-kilometer site-catchment areas.

Chapter 8 presents some comparative studies that can be used as analogies to interpret Great Oasis culture. These analogies will be drawn

from previous archaeological studies from the Midwest and from ethnographic parallels derived from historic Native Americans from the region.

In Chapter 9, the analysis of soils, spatiality, and theoretical human carrying capacity will be discussed. In this final chapter conclusions will be drawn and discussed.



## CHAPTER 2. THEORETICAL OVERVIEW

### Site-Catchment Analysis

Site-catchment analysis uses a variety of techniques that are dependent on such factors as the type of the research question(s) asked, the point of view of the investigators, the scope of the research project, and the unique circumstances of a given site. Site-catchment analysis is not so much as a single way of interpreting archaeological data but rather a set of techniques to analyze data. Examples of the differing approaches will be given. Site-catchment analysis remains an integral part of settlement studies as a whole.

Von Thünen is credited in 1826 with the first studies of the spatial modeling in European agrarian communities. In his model, isolated populations in a uniform environment created concentric rings for land use. The greatest intensity of resource extraction is closest to the settlement with forest and cropland at the next level. In the outer ring the land is primarily devoted to livestock raising (Butzer 1982:216-218). Roper cites Vita-Finzi and Higgs as being the first to coin the term "site-catchment analysis" in 1970 (Roper 1979:120). Their definition stated that site-catchment analysis was "the study of the relationships between technology and those natural resources lying within economic range of individual sites" (Vita-Finzi and Higgs 1970:5). As one dissects this statement it is soon realized that a seemingly straightforward definition is actually rather complex and open to interpretation. The term "site-catchment" is derived from a geomorphological analogy of the area of water catchment of a

particular stream or drainage system (Roper 1979:120). Essentially, site-catchment analysis is a process by which the researcher makes assessments of environmental conditions and resource potential at a given site. The investigator then uses that information to define the limits of a given territory of a particular prehistoric human population (Roper 1979:122) and thereby assist in the theoretical reconstruction of their subsistence and economic behavior. The site remains the focal point of a larger area of economic activity (Roper 1979:120). The location of the site and its artifactual contents and their interrelatedness are integral components of settlement study (Tiffany and Abbott 1982:314).

Site-catchment analysis is based on numerous procedural assumptions. The first assumption is that human populations tend to exploit resources most intensively at the locus of the site and as one moves further away from the site, the resource use in the surrounding area declines (Roper 1979:120). As one continues to move further away from the site, it eventually becomes unprofitable to exploit increasingly distant resources. The result is a zonal resource exploitation pattern where the most basic or essential resources are nearby. The local inhabitants then must make willing investitures of time and/or energy to procure more distant resources they deem necessary or attractive (Roper 1979:120-121). Roper continues by describing concentric resource territories with the site being at the center and thus possessing the greatest quantity of resources (1979:122).

The next assumptions to be made are those in association with delimiting the territory of a site-catchment. Although somewhat arbitrary, Vita-Finzi and Higgs base their models on the distance one would walk

reasonably from a site locus as the radius of resource exploitation (catchment) area. Their models use a 1 hour's walk for agricultural sites and a 2 hour's walk for hunting and gathering sites (Higgs 1975:223). This equates roughly to circles 5 and 10 kilometers in diameter, respectively. The boundaries of these "rings" may be adjustable to account for local conditions and topography (Butzer 1982:218). There is a tendency for investigators to use fixed radii rather than time intervals in delimiting site-catchments. Existing maps help to facilitate this process (Roper 1979:123-124). For the purposes of this study, a 1-kilometer site-catchment radius has been selected. Due to the variety of potential resources in the Noah's Bottom and Lower South Raccoon River localities (rivers, soil types, forest complexes, savannas, etc.) a smaller site-catchment radius was preferred rather than the 5-10 kilometer radius as suggested by Higgs.

Another assumption to be made is that all land types within a catchment are not of equal value (Higgs 1975:223). In order to assess the overall resource potential of a given area, land should be typed in reference to its overall nature and its productivity (Higgs 1975:223). Criteria used in assessing resource potential would include such factors as soil types, water resources, land forms, and current plant and animal populations (Higgs 1975: 223-224). Vita-Finzi and Higgs weigh the overall potential of agricultural land (Roper 1979:128) but as Flannery points out, "productivity" is a relative term as productivity can vary over time due to cultural or technological changes (1976:92-94). Determining land productivity through local soil types helps in estimating human population and the human carrying capacity of the catchment (Roper 1979:134).

Butzer points out additional assumptions in site-catchment analysis. Since site-catchment analysis is a subsistence-based model, there is an assumed stable relationship between the site inhabitants and the environment in order to not over-exploit resources (Butzer 1982:154). Human impact on the environment, therefore, should be evident through archaeological data. Higgs echoes this sentiment, instructing the investigator to estimate changes in the catchment as a clue to potential changes in productivity (1975:223).

There are some areas in which site-catchment is open to critique. As mentioned, soil "productivity" remains a relative term. Also the percentage of arable land can be a combination of environmental and cultural factors (Flannery 1976:92-93). Some researchers will conduct a simplified analysis based on a limited number of variables such as soil type or vegetation. This is acceptable so long as the research design is specific and limited. More generalized or complex research problems require multivariate regression analysis in order to be valuable (Roper 1979:126). Some site-catchment analyses assume that all land within the catchment is of equal value (Roper 1979:128). Butzer (1981:218) gives three criticisms in site-catchment analysis (1982:218). The first is that in some studies modern land-use categories are used to define hunter-gatherers. The second issue he criticizes is assuming that Pleistocene biotic distributions were the same or similar as today. He finishes by stating the interaction of environment and technology is not well defined. In this study, Pleistocene environments are reviewed only to interpret landforms. Biotic resource modeling has been completed through climatological studies and historical documentation.

The strengths of site-catchment analysis are as follows. The process helps to define the spatial parameters of a research project. It places a major emphasis on using economic models to reconstruct past human behavior (Roper 1979:131). Through site-catchment analysis, the archaeologist is compelled to make thorough environmental assessments. Site-catchment analysis can be a highly instructive aid in modern land use planning, especially when aided with computer imaging. The value of this point is made even more pronounced when, with the aid of computer graphics, a series of contiguous sites are analyzed to show interaction spheres within a locality or region.

In the following section, two studies using variations of site-catchment analysis will be reviewed. The contrasting approaches show the adaptability of site-catchment analysis.

In Flannery's 1976 study of the Oaxaca and Tehuacan River valleys, he removed arbitrary catchment boundaries. Rather than modeling in the manner of Vita-Finzi and Higgs, Flannery chose to reverse their system of interpretation. Vita-Finzi and Higgs would normally begin with a specific site-catchment and determine what resources in that catchment would be available to its inhabitants (Flannery 1976:103). Flannery used the empirical data from extensive plant, animal, and mineral analysis to develop his research design (1976:103). Regarding resources, Flannery posed the inverse question "From how far must they have come (1976:103)?" Key to his research was population estimates of the sites' inhabitants and the percentage of arable land (Flannery 1976:107). His conclusions showed that there was a zonal pattern of resource use (as would be expected by Vita-Finzi and Higgs) with the most essential resources being extracted nearby.

However, the overall catchment area with regard to exotic trade items was much larger than would have been developed by Vita-Finzi and Higgs (Flannery 1976:117). The value of this project was to free the investigator from arbitrary boundaries that might limit inquiry.

A second case study using site-catchment analysis reviewed in this paper is that of a Central Plains Tradition component in the Glenwood locality described by Tiffany and Abbott in 1982. Due to the nature of their work through the Office of the State Archaeologist (OSA) of Iowa, the site-catchment model of Vita-Finzi and Higgs required some modification (Tiffany and Abbott 1982:315). The OSA projects examined were small in scale and generally are the result of some type of federally funded impact (development) that could disrupt cultural resources. The derivation of site-catchment employed by Tiffany and Abbott can be considered efficient without sacrificing thoroughness. They use a prediction model for site location based on environmental diversity and environmental reconstructions derived from soil and landform maps and scientific and archival records of plant communities (Tiffany and Abbott 1982:315, 322).

The first step in Tiffany and Abbott's model was to make a detailed environmental model using mineralogical, hydrological, and vegetational resources of the proposed project location (Tiffany and Abbott 1982:315). The next step was to place an overlay of fixed radii (50 to 500 meters) over the project location. With these in place the researchers then total the number of resources in each circle and predict (through diversity) if the study area is likely to contain a site. The next phase was to visually survey the project location to verify site locations and conduct more

intensive environmental and cultural analysis if warranted. At this time the model prediction was tested (Tiffany and Abbott 1982:315).

The third example of site-catchment analysis was conducted by Schermer and Tiffany (1985) to model the location of Woodland sites at the Coralville Reservoir near Iowa City, Iowa. They show, through statistical analysis, these sites are at locations with a relatively greater environmental diversity (soil types, landforms, and vegetation) than other locations selected at random (Schermer and Tiffany 1985:216). In this study, Schermer and Tiffany used site-catchments of 100 meters, 500 meters, and 1 kilometer. The catchments were assayed for resource potential and assigned an index based on environmental diversity. They concluded their analysis: "The Woodland stage sites are disproportionately located on low terraces, on soil types with good drainage capabilities, within 500 meters of a water source, and within 500 meters of forest vegetation" (Schermer and Tiffany 1985:225).

In the case of the Central Plains component at the Glenwood locality, site-catchment analysis accurately predicted the existence of a house site (13ML1) in the Foothills Park project area (Tiffany and Abbott 1982:318). Their findings complemented the duality of the Central Plains tradition's settlement pattern as identified by previous investigators (Tiffany and Abbott 1982:318-320). In the example of the Woodland sites at Coralville, a predictive model based on environmental diversity was verified through site location.

The examples given show the flexibility and adaptability of site-catchment analysis from the original model of Vita-Finzi and Higgs. In the first case, the settlement pattern of a series of sites were described

through site-catchment analysis. Arbitrary boundaries were not set in order to remove limitations on the researchers in such matters as agricultural land, population, and the size of the catchment as a result of trade. The second examples are of projects of much smaller scope using fixed radii as an aid for site location by resource diversity. The third case was an adaptation of the second on a broader scale. Each case is equally valid within the context of its original research design.

This study uses a hybrid of those methods employed by Flannery, Vita-Finzi and Higgs, Tiffany and Abbott, and Schermer and Tiffany. Not only does this study use fixed radii and resource assays, but also considers spatial analysis and likely travel routes along rivers and overland between sites following the perspective of Flannery.



### CHAPTER 3. METHODS AND ANALYTIC PROCEDURES

This research project was completed in eight steps to address the research questions posed, but there is significant overlap between these steps.

This research project was confined to Boone, Dallas, and Polk counties of Iowa and the lower drainages of the Des Moines and Raccoon Rivers. These sites are all within one day's travel to the confluence of the Des Moines and Raccoon Rivers. Great Oasis ceramics have been located at sites along the Des Moines River in Webster County. These include the gypsum Quarry site (13WB1), 13WB40, and 13WB153 (Tiffany and Alex, 1999:71). They have not been included in this study due to their distance from other known Great Oasis sites. Additionally, the Gypsum Quarry site has been obliterated and the artifacts from other Webster County sites were not available for review. There may be other Great Oasis sites in Webster and northern Boone counties which are yet to be identified. Other single Great Oasis sites outside the Des Moines-Raccoon drainage exist as outliers such as Woodpecker Cave (13JH202) (Caldwell 1961; Tiffany and Alex 1999:70).

Step I. Developing a Master List of Great Oasis Component Sites in the Study Area. From literature in the 1960s through the present time (Anderson 1975; Benn 1985, 1986; Benn and Bettis 1985; Broihahn 1997; Doershuk 1996; Doershuk and Finney 1995; Finney 1994; Gradwohl 1974, 1978, 1991; Henning 1971; Tiffany 1983, 1991; Tiffany and Alex 1999) it appears

that archaeological sites with Great Oasis components in central Iowa are clustered in two main areas with a third yet undetermined locality.

In Boone County, a number of Great Oasis component sites are clustered along the Des Moines River north and south of the town of Moingona in the vicinity of the confluence of Noah Creek and the Des Moines River. This area has been named the Noah's Bottom locality (Figures 1 and 2). This name was derived from the term given the area by the first Euro-American settlers in that vicinity in 1848 (Goldthwait 1914:283). The area includes Logansport (13BN103) in the north to Hubby (13BN38) at the southern end of the locality, a distance of approximately 16.15 kilometers if traveled via the Des Moines River.

In Dallas County, areas with Great Oasis sites are primarily along the South Raccoon River between the confluence of the Middle Raccoon River and the South Raccoon River and its downstream confluence with the North Raccoon River (Figures 1 and 3). From this confluence until it empties into the Des Moines River, it is simply referred to as the Raccoon River. As of yet, no Great Oasis sites have been located on the terraces of the Raccoon River proper and none have been observed upstream of the Maxwell Site (13DA264) on the South Raccoon. In order to avoid confusion, this area containing Great Oasis components is referred to as the Lower South Raccoon River Valley Locality and encompasses approximately 27 kilometers along a river travel route.

In Polk County, the only confirmed Great Oasis component is the West Des Moines Burial (13PK38). No habitation sites have been located in conjunction with this cemetery. The topography and soil types along Walnut

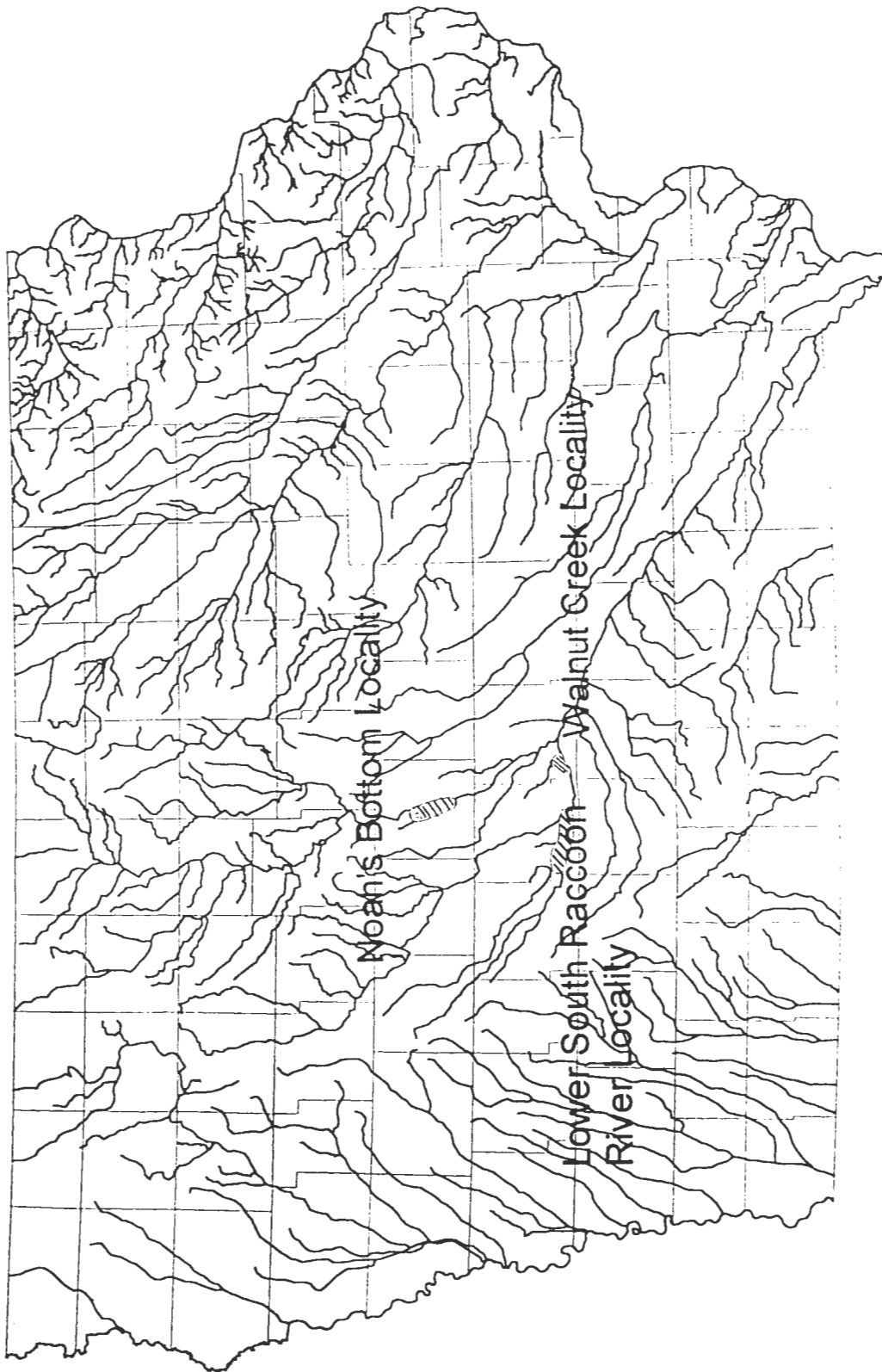


Figure 1. Map of Iowa showing Boone and Dallas localities and proposed Polk County locality.

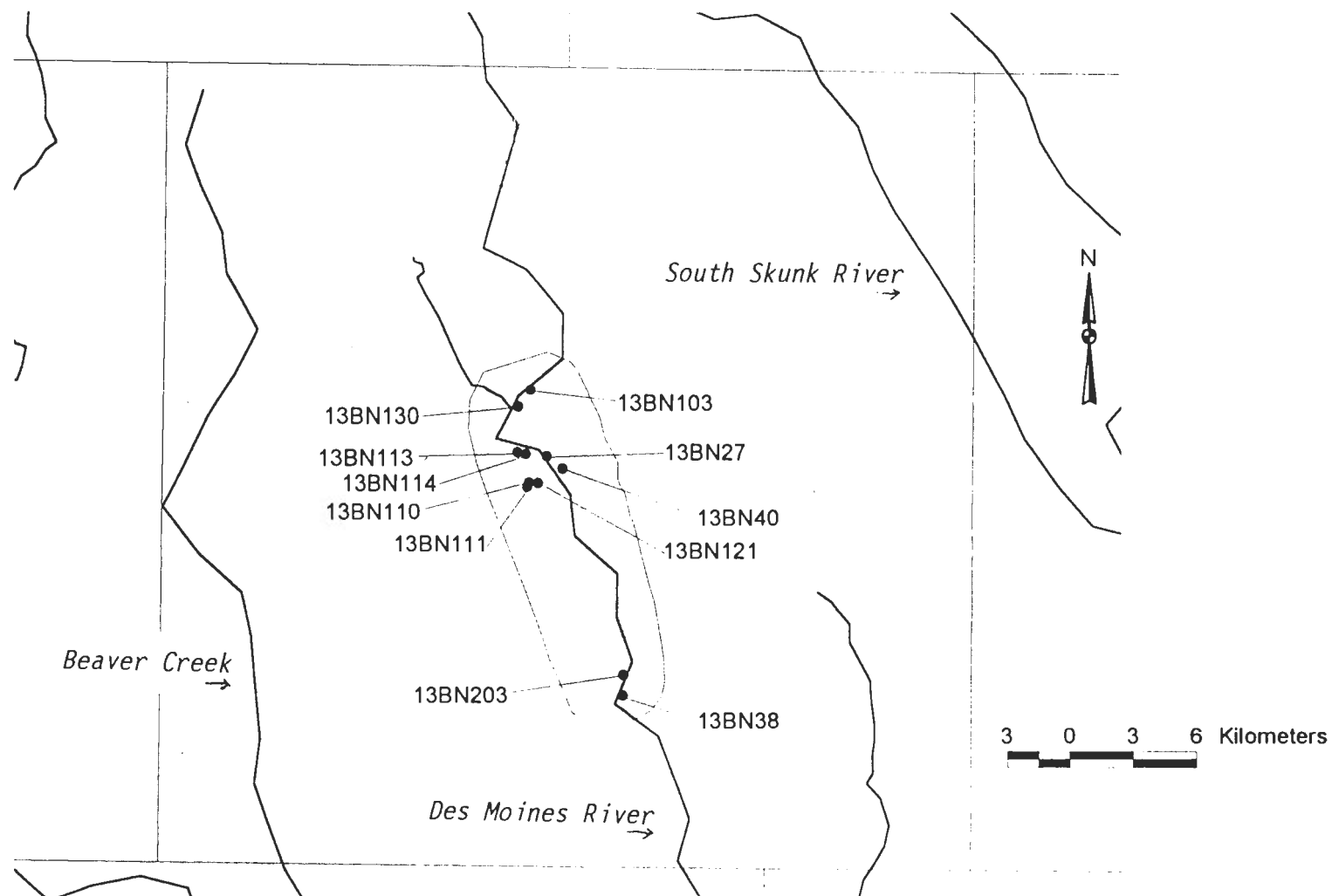


Figure 2. Noah's Bottom Locality, Boone County, Iowa.

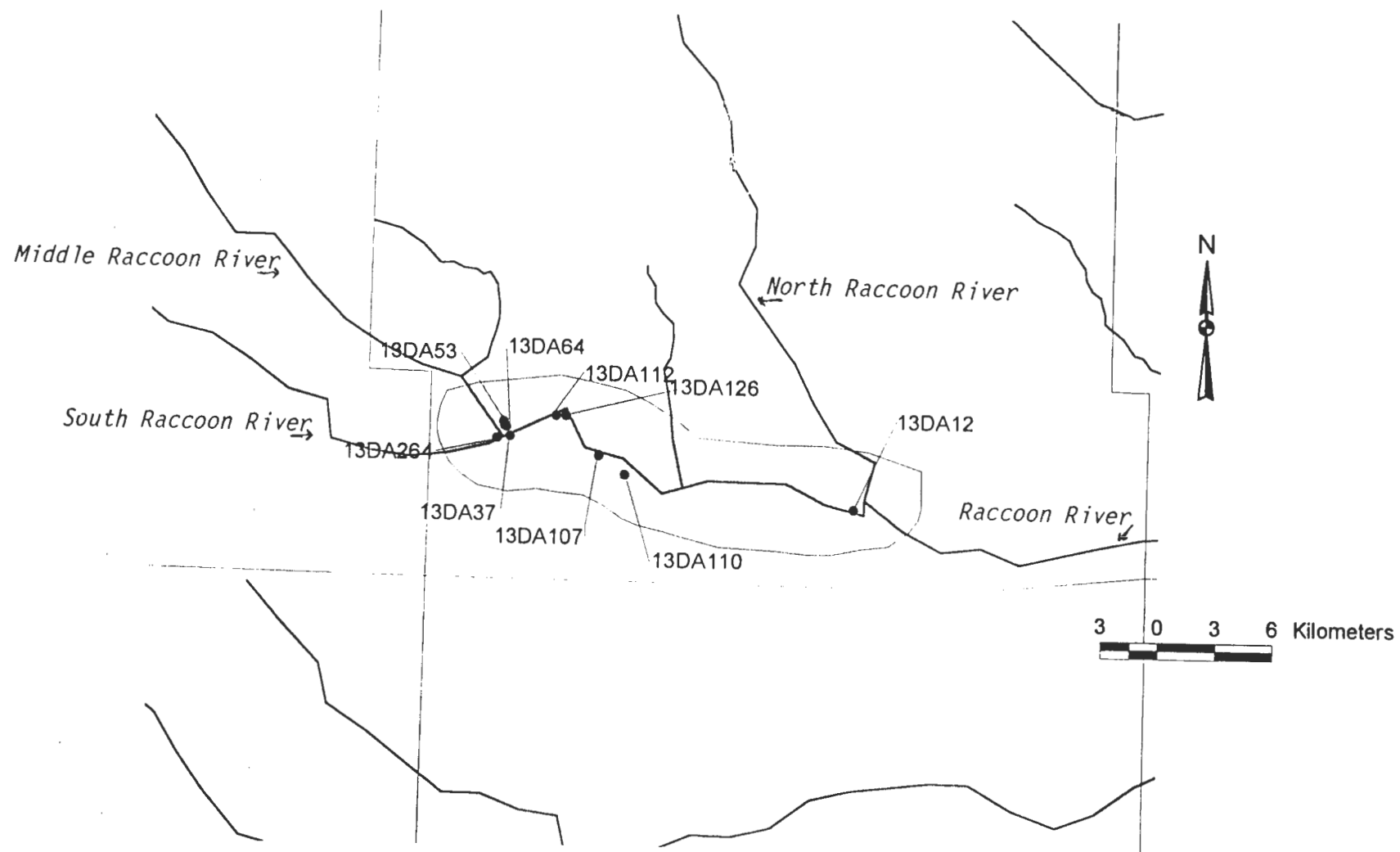


Figure 3. Lower South Raccoon River Valley locality, Dallas County, Iowa.

Creek and its confluence with the Raccoon River would support Great Oasis habitation as would the Raccoon River Valley proper. The valley of Walnut Creek with potential tillable land at the confluence of the Raccoon River is approximately 2.5 kilometers long and 1 kilometer in breadth at its widest point. This theoretical area has been named the Walnut Creek locality (Figures 1 and 4).

A tentative list of central Iowa Great Oasis sites was derived in three ways. The first was a literature review in which sites with Great Oasis components were referenced (Anderson 1975; Benn 1985; Benn and Bettis 1985; Broihahn 1997; Doershuk and Finney 1995, 1996; Finney 1994; Gradwohl 1991; Mead 1981; Tiffany 1981; Tiffany and Alex 1999). The second approach was a review of a computer-generated site list compiled by the Office of the State Archaeologist of Iowa (OSA) in Iowa City. The third method was a cursory review of site forms and reports at Iowa State University Archaeology Laboratory (ISUAL) to identify sites that could potentially have Great Oasis components and to verify OSA site records. These lists were compiled to form a master list of potential Great Oasis sites.

Step II. Great Oasis Site Verification. Once the list of potential Great Oasis sites was developed, each had to be verified. In order to do this, curated artifacts had to be examined. These artifacts were located at ISUAL, OSA, and the State Historical Society of Iowa in Des Moines.

The only practical method of Great Oasis verification is through ceramics. Great Oasis ceramics are distinctive (Johnson 1969:272) by their recurring motifs, globular form, relative thinness, and high quality of construction (Henning and King 1982:62). As an aid to this process of

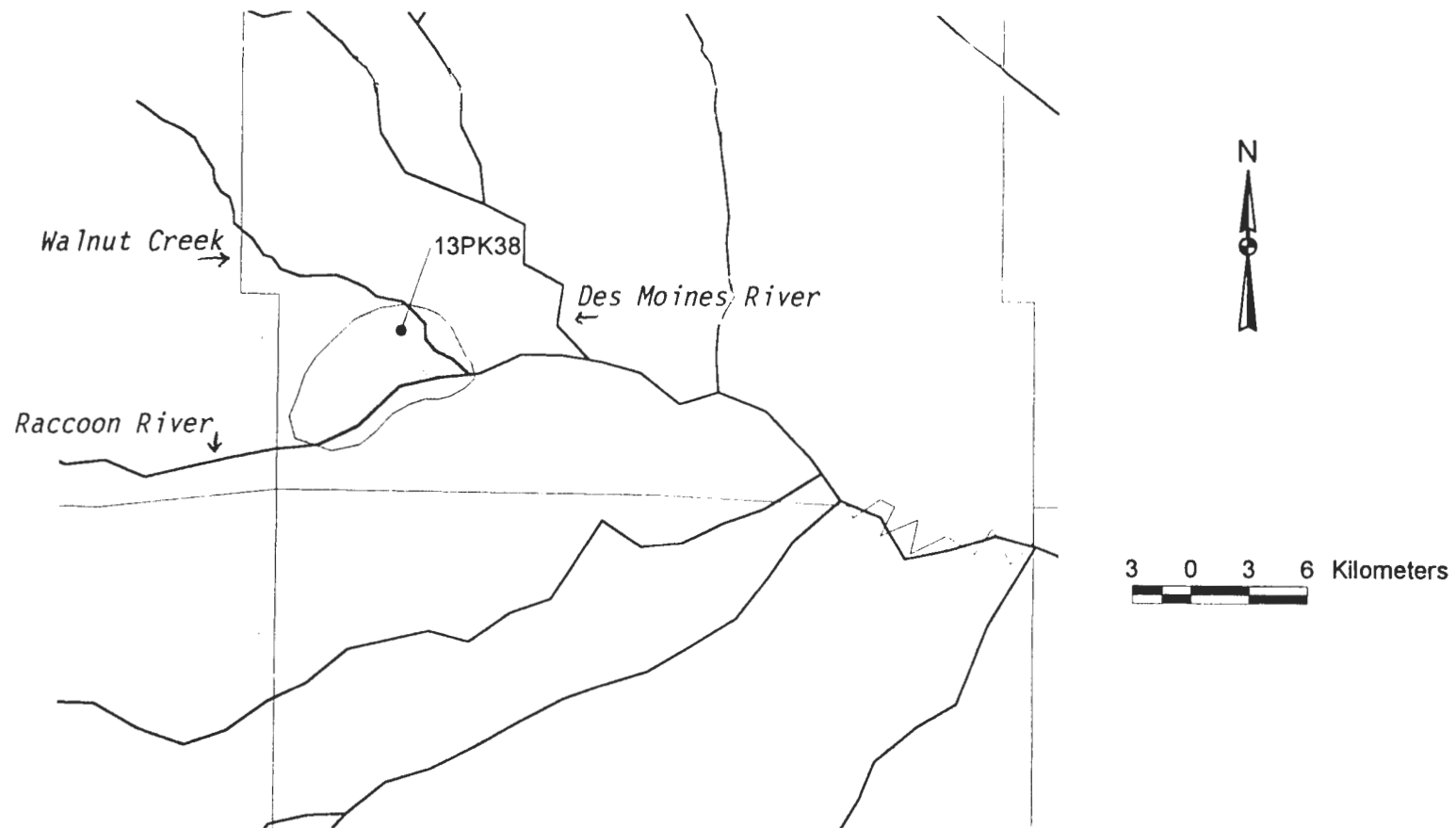


Figure 4. Proposed Walnut Creek locality, Polk County, Iowa.

analysis, a hierarchy of ceramic attributes was developed and titled the "Great Oasis Index Test" (GOIT). The GOIT has five levels from 1 (highly doubtful) to 5 (positive identification) as follows:

1 - At this level the validity of a Great Oasis component is supposition only. The determination of this site having a Great Oasis component is probably incorrect. Examples might include body sherds or triangular projectile points but no diagnostic Great Oasis pottery.

2 - This level has ceramic artifacts that may be of Great Oasis origin but could also be attributable to Late Woodland pottery (Benn 1990:138-144, Logan 1976). Included at this level are thin globular body sherds with smooth paste and sand or fine temper. These artifacts would be from surface finds or secondary contexts.

3 - This level includes probable Great Oasis rim sherds although the size or condition of the sherd makes identification more tenuous yet still very likely. The site location can be helpful at this level. There is a higher likelihood of a rim sherd fragment being of Great Oasis origin if it is found on an intermediate or high terrace along the Des Moines or South Raccoon Rivers or a major tributary.

4 - The site contains diagnostic Great Oasis rim sherds in surface surveys or in secondary contexts.

5 - The site contains diagnostic Great Oasis rim sherds or complete vessels found *in situ*.

Following the review of artifacts, the sites were rated and analysis progressed.

Step III. Mapping. The first step in this stage was to transfer the mapped locations of referenced sites from USGS topographical maps at OSA to



USGS maps used in this study. In the event that OSA did not have a site mapped that was confirmed to have a Great Oasis component (e.g. 13DA37), the original site form was reviewed at ISUAL. The sketch on the site form was then transferred to the USGS map used in the study.

The next step in this stage was to transfer the mapped locations of referenced sites from USGS topographical maps to aerial photographs found in the Boone, Dallas, and Polk County Soils Surveys by the United States Department of Agriculture.

Step IV. Soil Analysis. This stage was developed to address the types of soil on or within 1 kilometer of sites with confirmed Great Oasis sites. The distance was somewhat arbitrary but needs clarification. One kilometer (0.62 miles) seemed a reasonable distance for a person to conveniently tend fields. It is feasible that pregnant women, women with young children, or the elderly may be called upon to tend fields. Distances beyond 1 kilometer may be impractical and protecting crops from animals (deer, raccoons, bear, etc.) may be difficult at distances over 1 kilometer. In reality, 1 kilometer may actually be too far to be practical.

Once the referenced site was mapped onto the USDA Soil Survey aerial photograph, the center of the site was estimated. From this point, using a drafting compass, a 1-kilometer radius circle was drawn. Following this, a paper template with the same diameter was placed on the soil survey photograph and aligned with the circle drawn on the photograph. Next an "English Area Grid" is placed over the photograph and the paper template. Using the counting grid the acreage of particular soil units was estimated within a site-catchment (1 kilometer radius). Terraces referred to in this section are DeForest Formation Holocene terraces. Parameters for analysis

were surface area within 1 kilometer of: (a) tillable soil on the Low/Intermediate Terraces, (b) tillable soils on the Low/Intermediate/High Terraces, (c) tillable soil on the Low/Intermediate Terraces on the same side of the river and, (d) tillable soils on the Low/Intermediate/High Terraces on the same side of the river. These data were then compiled and analyzed through a statistical software package called *Mystat*. The final tabulations were then converted to hectares. The data were tabulated and entered as tables.

Step V. Spatial Analysis. This stage of research addresses the position of Great Oasis components in relation to each other and to the distance to bodies of water. Distances were calculated in a linear (straight line) fashion, along the route presumed to be the most logical for travel. This "travel route" is important in calculating distances along river courses. The measurement was done with a "PlanWheel"™ manufactured by the Scalex Corporation. The use of the PlanWheel allowed the researcher to accurately measure curvilinear distances. This tool was especially valuable when distances to be measured spanned more than one topographic map. Eight parameters were selected for measurement. These included:

1. Distance to nearest navigable stream--linear measurement (DNSL). This pertains to the most direct route to either the Des Moines River in the Boone County study area or the South or Middle Raccoon River in the Dallas County study area. This parameter is based on the assumption that the Great Oasis people depended on the local river as a source for food, water, communication, and travel. It is logical to assume Great Oasis people traveled by use of some form of watercraft.

2. Distance to nearest navigable stream--travel route (DNST). This parameter is basically the same as above (1). In most cases, the identical figure was found for both.

3. Distance to feeder stream--linear measurement (DFSL). On the Des Moines Lobe and along its margins, feeder streams tend to wash coarse gravel and cobbles into the main river channel. Much of this outwash is the Noah Creek Formation. These washes of glacial materials form natural bars on the river. These bars could serve several functions to the native inhabitants. These gravel bars tend to be productive fresh water mussel beds giving the local people an easily accessed source of protein. These gravel bars and the accompanying eddies could be used as fish weirs with minor modification. These bars can partially obstruct the river's flow and cause shallows to form. For example, in the case of Richardson Creek in Douglas Township of Boone County (approximately 4 kilometers downstream of Hubby [13BN38]), the 1911 USGS shows a ford crossing at the point of confluence with the Des Moines River. Feeder streams could serve as sheltered locations to beach a boat and serve as a landmark. Feeder streams probably would have fresher, cleaner water than the main channel of the river.

4. Distance to feeder stream--travel route (DFST). This is the same measurement as "3" but calculated on the most probable route taken by foot.

5. Distance to Nearest Great Oasis Site--linear measurement (DNGOSL). This measurement calculates the "nearest neighbor" via direct linear measurement. If there is a question of two mapped sites potentially being the same component (e.g., 13DA112 and Keufner [13DA126]) the next closest Great Oasis site is selected for measurement. It cannot be known if two

referenced components were occupied simultaneously. However, the statistical evidence and ethnographic parallels may reveal a sufficient resource base was available for contemporaneous occupation.

6. Distance to Nearest Great Oasis Site--travel route (DNGOST). This is the same measurement as above (5) but taken along a most logical travel route. This could be by foot or by watercraft. Currently, the Des Moines River freezes to a depth sufficient to support foot traffic in January and February. Theoretically, during the coldest times of the winter, the river could serve as a "road."

7. Distance to Focal Point--linear measurement (DFPL). The designation of a "focal point" is artificial. A site was selected from each locality that addresses some specified criteria. Focal points are strategically positioned for commanding views of the main water courses, were positioned within a constellation of other referenced sites, and had a greater than average amount of potentially tillable land adjacent to it. For the Noah's Bottom Locality, the Sparks site (13BN121) easily fits this criteria. The designation for the Lower South Raccoon River Locality was more arbitrary due to the shape of the valley and curvilinear configuration of the referenced sites. 13DA37 was selected on the basis of its proximity to the known Great Oasis burials and its higher than average amount of potentially tillable soils nearby. It was chosen over other sites in the area because it alone has an unrestricted view of the confluence of the South and Middle Raccoon Rivers.

8. Distance to Focal Point--travel Route (DFPT). This is the same measurement as "6" but along a route most logically traveled.

## CHAPTER 4. GREAT OASIS OVERVIEW

The distribution of reported Great Oasis village and burial sites is bounded by habitation areas in southwest Minnesota, a corridor along both sides of the Missouri River beginning at the mouth of the Little Sioux River and extending to the present location of Pierre, South Dakota, and the Des Moines River drainage in Central Iowa and North-Central Iowa with the City of Des Moines being the most southern and eastern point (Henning 1971:130,133) (Figure 5). Great Oasis sites in Iowa lie predominately along the Big Sioux and Floyd drainages of northwest Iowa. There is also clear spatial clustering of Great Oasis sites in central Iowa in Boone County along the Des Moines River Valley and in Dallas County along the South Raccoon River. Figures 2 and 3 show only those sites identified as Great Oasis. Other Great Oasis sites are yet to be identified. For example, the private collections of local residents of the town of Redfield, Iowa, along the Middle and South Raccoon Rivers near Redfield, Iowa, may give evidence of a fairly strong Great Oasis component, but in-depth analysis of local collectors' holdings has not yet taken place (Gradwohl personal communication, 24 March 1993). Attempts were made in May 1997 to review these private collections, but were unsuccessful. The Pardekooper collection appears to be dispersed, and the possessors of the DeCamp collection are reluctant to open it for viewing. Radiocarbon assays in Iowa derived from Great Oasis sites yield dates from approximately AD 850 to AD 1260 (Tiffany 1981:62). Recently, Lensink and Tiffany question the precision of these radiocarbon dates and state that a revised

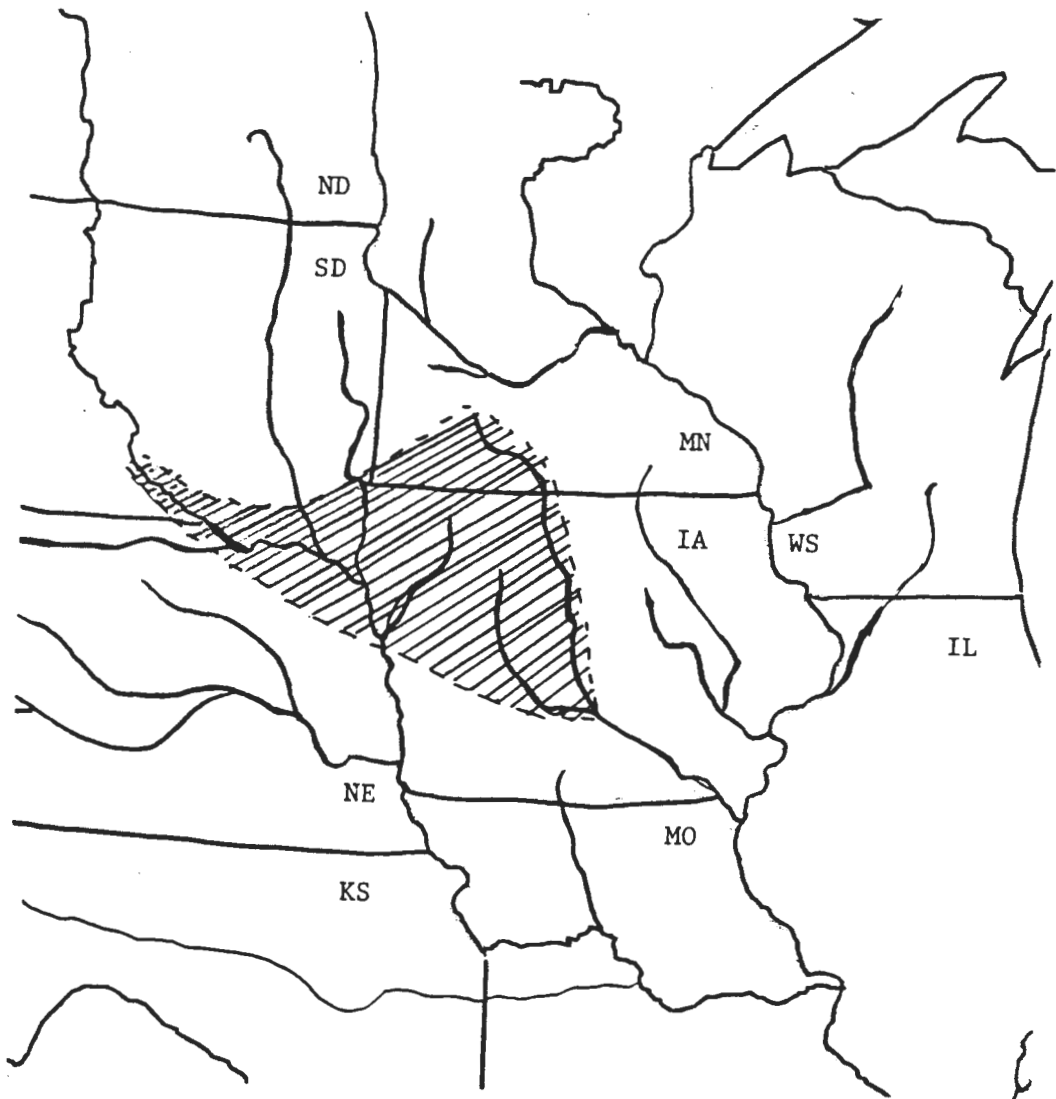


Figure 5. Map showing the location of the maximum extent of the Great Oasis Aspect as defined by Henning (1971).



interpretation gives a temporal compression resulting from calibration from AD 950 to AD 1100 (Lensink and Tiffany 1999).

The Great Oasis culture was first identified by Lloyd Wilford in 1942 and named for the now extinct Lake Great Oasis in Murray County, southwest Minnesota (Henning 1971:124, Wilford 1942:23). The Low Village site (21MU2) was the first controlled excavation of a Great Oasis site. This Great Oasis type site was situated on a former lake shore. The lake bed has subsequently been converted into crop land and the original site to a feed lot (Nancy Osborn-Johnson: personal communication 3 April 1993). Using the Midwest Taxonomic System, Wilford ascribed the Great Oasis aspect to the Mississippi pattern due to its advanced agriculture system and the presence of storage pits, although some Woodland characteristics did exist (Wilford 1945:32,38). Other scholars would later disagree with this classification. Wilford speculated on the possibility of the Great Oasis culture being ancestral to the modern Omaha, but this is not widely accepted because the chronologies of the respective cultures do not correspond (Henning 1971:127).

Gradwohl interprets the data by placing the Great Oasis culture in the Post-Woodland period. He thinks it is possibly the eastern extension of the Initial Middle Missouri tradition (Gradwohl 1978:47). Henning counters by acknowledging a strong possibility of a chronological overlap between terminal Late Woodland cultures and early Great Oasis (Henning 1971:126, 127). This view is not universally held. Benn's interpretation partially combines the ideas of Gradwohl and Henning. Benn refers to a continued debate in placing the Great Oasis culture in Late Woodland versus Initial Middle Missouri tradition (Benn 1985:51). He described Great Oasis culture

as Initial Variant of the Middle Missouri tradition (Benn 1985:56) and later refined his position as the possibility may exist that the Great Oasis culture is an antecedent to the Initial Variant (Benn 1986:29). To complicate the temporal aspects of the Great Oasis culture, uncalibrated radiocarbon dates place the early Great Oasis well within Late Woodland period and through and beyond the generally accepted Mississippian era of influence. Tiffany strongly points out, based on numerous cultural remains other than house type and temporal considerations, the Great Oasis culture is more correctly categorized as Terminal Late Woodland (Tiffany and Alex 1999:84-91). The calibrated Great Oasis radiocarbon dates support this assumption. For the purposes of this study, Tiffany's classification is most plausible and will be accepted.

#### Physical Manifestations of the Great Oasis Culture

The single most diagnostic feature of Great Oasis culture is the ceramics. In general terms, Great Oasis pottery is globular in shape with a constricted orifice, grit tempered and colored red, gray, tan, or black (Wilford 1945:35). Although there are numerous classification schemes for Great Oasis ceramics, the typology presented by Henning and Henning (1978) is concise yet thorough and has been selected for this study. Great Oasis ceramics is classified into two wares: Great Oasis High Rim and Great Oasis Wedge Lip, the latter being subdivided into Plain and Decorated. Great Oasis pottery lacks handles or lugs (Wilford 1945:39), is relatively thin, and of a very high quality (Henning and King 1982:17-18). The bodies of the vessels are usually given a cord-wrapped paddle treatment similar to Late Woodland pottery, but Great Oasis ceramics shows finer and more uniform cord markings on the vessel bodies with some occasional evidence of



polishing (Wilford 1945:35-36). Other than cord markings and smoothed-over cord markings, vessel bodies show infrequent decoration. Great Oasis High Rim ware reflects vessels with fairly straight rims and flared from the shoulder of the pot with a sharp angular interior rim/neck juncture (Henning 1982:59) (Figure 6). These rims were given decorative treatments that heavily employed geometric designs of trailed horizontal lines crossed over by triangles and/or zig-zags, or both (Johnson 1969:272-276). Wedge Lip pottery has a short, thickened rim which is triangular in cross-section at the orifice and is either plain or decorated. The interior rim/neck juncture is angular and flat and highly beveled toward the vessel exterior, hence the name Wedge Lip (Figure 7). The decorated styles show trailed tool impressions such as fine cross-hatches or small regularly-spaced blunt tool impressions (Williams 1975:5-15). See Figure 8.

In addition to typical Great Oasis ceramics, several S-shaped rims have been recovered in Great Oasis sites. Doershuk and Finney (1996:28) report two S-shaped rims found at the Maxwell Site (13DA264). Broihahn (1997:17,18) reports a partially restored vessel resembling Forman S-Rim Ware or Grass Rope Ware which may be in association with Great Oasis cultural remains. An additional S-shaped rim was recovered from Meehan-Schell (13BN110), and the Cowan site (13WD88) (Morrow 1999:242-243).

Great Oasis lithics include projectile points, celts, sandstone abraders, worked and unworked red pipestone, scoria, bifacial and unifacial scrapers, flake tools, and miscellaneous grinding and milling stones (Henning 1982:131-173). The projectile points are generally small triangular or multiple-notched points (Morrow 1984:80) and are presumed to be arrow points rather than spear points (Anderson 1975:36).

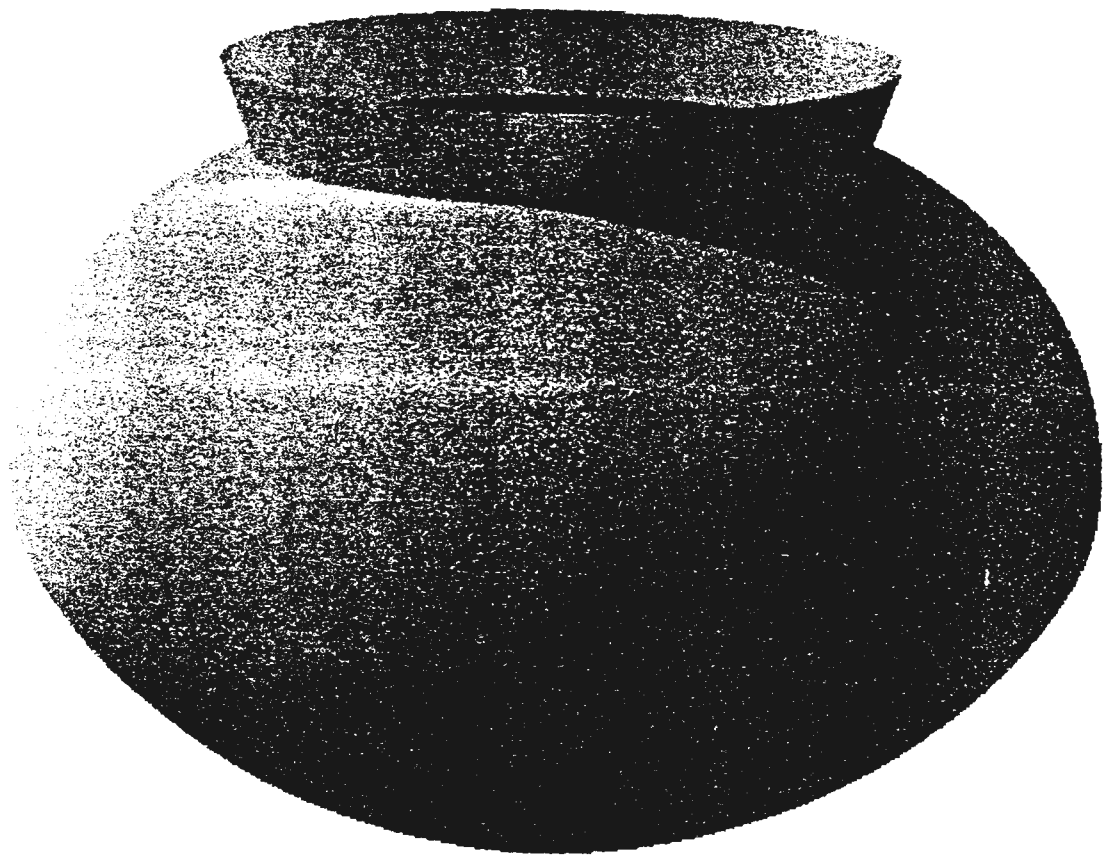
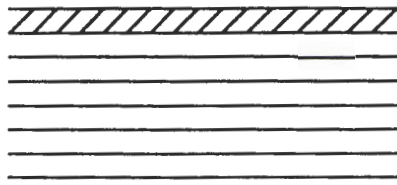
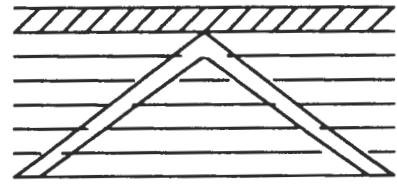


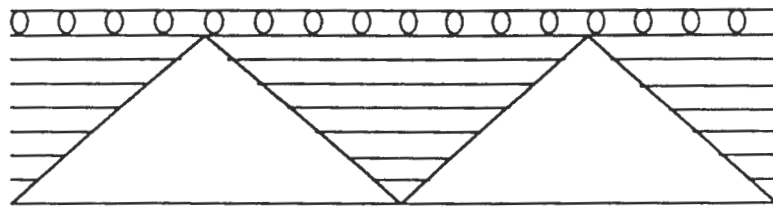
Figure 6. Schematic representation of Great Oasis High rim plain vessel.  
(Graphics by Max C. Wirth.)



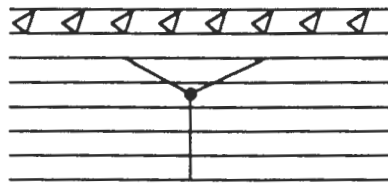
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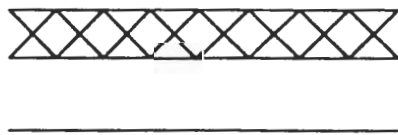
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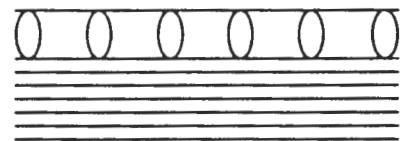
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e



f

Figure 7. Schematic representations of examples of Great Oasis ceramic vessel rim decorations: a, b, c, d - Great Oasis High Rim - incised  
e, f - Great Oasis Wedge Lip

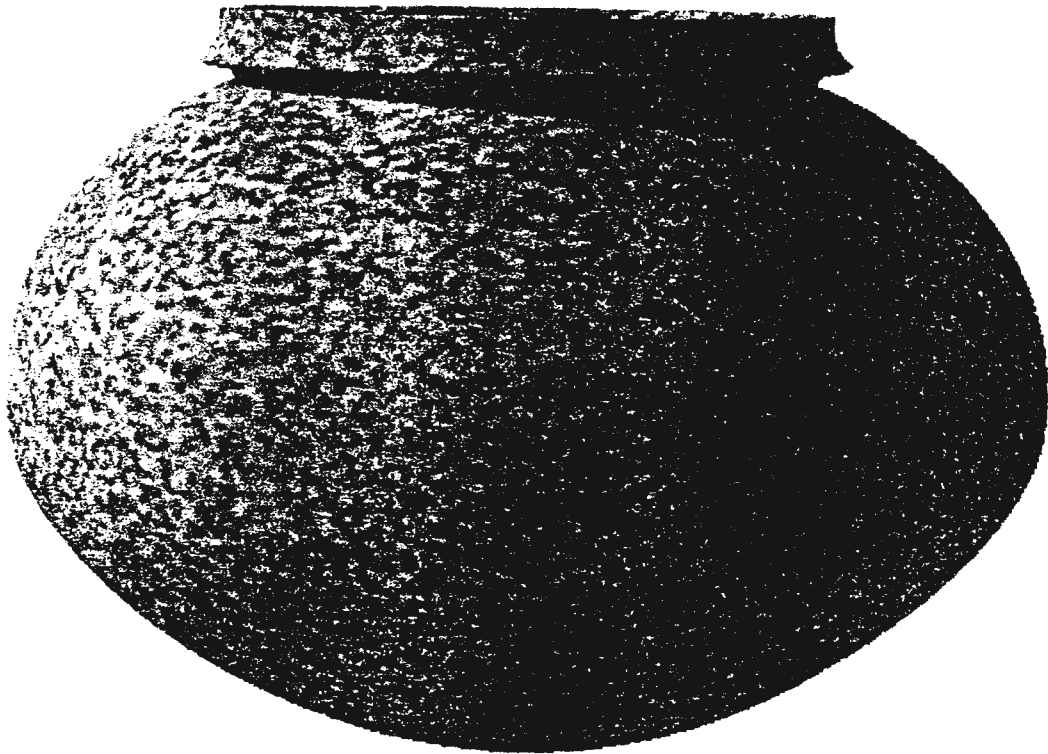


Figure 8. Schematic representation of Great Oasis Wedge Lip vessel.

Great Oasis people employed bone for various purposes as evidenced by bone artifacts found within archaeological contexts (Morrow 1999:313-323). Some representative artifacts include antler flaking tools, worked deer mandibles, splinter and bird bone awls, serrated hide flesher, and bone and tooth ornaments (Henning 1982:175-199). Conclusive evidence of scapula hoe blades have not been found in Great Oasis sites near Des Moines or in the lower Raccoon River drainage. Elk and bison scapula hoe blades have been recovered at the Blosser Site (13BN125) but their affiliation with Great Oasis is only tentative (Broihahn 1997:34-35). Worked shell (both local and exotic) has been found at Great Oasis sites. This will be discussed in greater detail at a later point in this thesis.

#### Subsistence and Settlement Patterns

A review of the archaeological data indicates a varied economy based on hunting and gathering supplemented by farming (Anderson 1975:35-36). Archaeological data refer not only to the artifact inventories but also the size, shape, location, and context of features that would imply some use pattern.

Faunal remains at Great Oasis sites indicate that the inhabitants relied on fish, birds, deer, and a relatively low percentage of bison (Baerreis 1970, Henning 1971:128). In addition, a less significant number of elk, wolf, beaver, gopher, rabbit, mole, mouse, and coyote remains had been recovered from storage pits (Anderson 1975:35) presumably converted into trash pits upon fouling or disrepair.

Floral remains from Great Oasis sites give evidence of both foraging for wild plant food and strong indications for the production of cultivated crops. The floral analysis of the Meehan-Schell site (13BN110) can be shown

as an example of plant foods used by Great Oasis people. Along with wild edible nut and berry remains found, carbonized seeds of corn, squash, and domesticated sunflower were recovered. In addition, fairly high concentrations of *Chenopodium* seeds were found (Mead 1981:59). Scapula hoe blades such as those found at the Larsen Site (13PM61) give supporting evidence to Great Oasis horticultural practices (Henning 1982:189,190). As noted, however, the Larsen Site is mixed and the hoes may be more correctly attributed to Mill Creek. A probable scapula hoe blade was recovered at the Cowan site (13WD88) (Morrow 1999:314) which gives stronger supporting evidence of the hoe being used by the Great Oasis people, at least in northwest Iowa.

There is no evidence in central Iowa to the exact manner of how the Great Oasis people planted their crops. The author proposes an agricultural system that relies more on hand weeding of croplands and the use of companion cropping. *Chenopodium* could have been broadcast between the hills of corn or squash to shade out unwanted weeds. Maxi'diwiac referred to sprouting squash seeds in her lodge and later planting them (Wilson 1917:68-69). Perhaps a similar technique was used by the Great Oasis. Squash vines can be trained for position among other crops and the broad leaves would shade undesirable annuals.

The subsistence activities of the Great Oasis people are reflected in the settlement pattern. Archaeological data suggest some amount of seasonality with the main villages being abandoned in the summer and the population dispersing to smaller more isolated groups for cultivation (Anderson 1975:36-37). The Great Oasis habitation sites in central Iowa are



usually on terraces above the normal flood plains of streams and rivers. There is currently no evidence of fortifications on any Great Oasis site.

Great Oasis house types vary. Those at the Broken Kettle West site (13PM25) (a presumed year-round habitation site) give the impression of permanence. These are rectangular in shape and one house excavated at 13PM25 measured approximately 12.19 meters by 7.62 meters with a double set of post molds as an outline, a central hearth, numerous interior post molds and cache pits and a narrow, enclosed south-facing entrance. The floor of the same house was hard packed clay (Anderson 1975:40). The configuration of the post molds is suggestive of wattle and daub construction (Benn 1985:56). At the Broken Kettle West site, remains of charred grasses were found within the house features suggesting that the roof was thatched. The house structure data from the Williams site (13PM50) also appear to indicate a structure of wattle and daub construction (bits of daub with grass impressions were found) but no post molds were located (Williams 1975:15,20). Post molds were located at the Cowan, Meehan-Schell, Maxwell, and Heath (39LN15) sites. Because the interpretation of the data from the Williams site indicates short-term occupation (Williams 1975:26-27), it stands to reason that the dwellings at the seasonal encampments were smaller and less substantial versions of the permanent structures. At the Broken Kettle West Site (13PM25), cache pit features within a single house show floral and faunal evidence of fall, winter, and spring occupation (Baerreis 1970:3-15). However, there may be cultural factors that could explain the lack of evidence for summer occupation of this particular house. For example, perhaps the occupants of this house were not inclined to dispose of organic refuse inside a house during the warmer months.

Recent excavations in Dallas County, Iowa, at Maxwell and Kuehn (13DA110) show strong evidence of Great Oasis settlement pattern and semi-subterranean dwellings. Although the analysis of both sites is yet unfinished, diagnostic artifacts (Great Oasis ceramics) have been recovered in situ at Maxwell (Doershuk and Finney 1996:14) and the storage pit (Feature 1) of Kuehn excavated by Finney in 1994 (Lensink and Finney 1995:8). Surface surveys at Kuehn show an extensive surface scatter of lithic materials and fire-cracked rock. A probable house site at Feature 8 of Kuehn has not yet been conclusively identified as Great Oasis. At Feature 8 thin, globular, fine paste ceramic body sherds found within context could be either Great Oasis or Late Woodland. Feature 8 showed apparent burned roof or wall timbers, daub, possible roof thatch, a living surface basin, a burned earth hearth, and post molds. If Feature 8 is in fact attributable to the Great Oasis culture, it is strongly reminiscent of the house excavation at the Williams site. Additional excavation at the Kuehn site would be helpful in clarifying the remaining questions.

The location of Great Oasis sites show some amount of variation regionally. The Low site in southwest Minnesota is on the shore of a former lake (Henning 1971:124). Sites such as Maxwell and Landis (13DA12) along the Raccoon River are on terraces near the confluence of navigable streams. The Logansport site (13BN103) and 13BN203 are on terraces directly on the Des Moines River. The Heath site (39LN15) of southeastern South Dakota follows this same pattern, being located on terraces of the Big Sioux River (Hannus, Winham, and Lueck 1986:40). The Hitchell site on the banks of the Missouri River in Charles Mix County, South Dakota, is an example of Great Oasis occupation on a terrace of a major water course (Johnston 1967:3,



66-72). The Meehan-Schell site and Noah Creek Kiln (13BN111) are on terraces of feeder streams to the nearby Des Moines River, also along a major river terrace system.

Great Oasis people favored hill top locations for their cemeteries (Schlesier 1994:343). This is exemplified by the West Des Moines burials (13PK38) and the probable Great Oasis burials at DeCamp (13DA64). The low mound features at the West Des Moines and DeCamp burials appear to be the result of an aggregate of inhumations (Tiffany and Alex 1999:3-5).

### Synthesis with Other Cultures

The archaeological evidence shows that although there were probably ample opportunities for Great Oasis people to interact with other cultural groups, they did so without compromising their own cultural identity. The Great Oasis culture is usually most closely associated with the Initial Middle Missouri variant Mill Creek culture. Both the ceramic and lithic patterns of each culture are strikingly similar and Henning feels both groups appear to have occupied the same localities in northwest Iowa at the same time (Henning 1971:27,128). Henning also feels the Larsen site (13PM61) represents a period of joint occupation of both Mill Creek and Great Oasis cultures (1982:192-193) although he concedes the site may be "mixed" (1996:15). Tiffany, Alex and Anderson (1998:97-98) interpret the Larsen site as a "mixed" site and the Great Oasis and Mill Creek components are not contemporaneous. This may be explained by the quantities of soil disturbed when building semi-subterranean houses apparently preferred by Great Oasis and Mill Creek peoples. The Terminal Late Woodland Great Oasis were probably ancestral to the Mill Creek (Alex 1981:40; Tiffany 1983:20; 1991:188; Tiffany and Alex 1999:87-90). This view is important to this

study. On the basis of an discriminate function analysis of 80 craniometric variables, Key clearly shows a close biological relationship between the Great Oasis and Mill Creek cultures (1994:179-180, 185).

Trade goods found within an archaeological context are a strong indication of interaction (both direct and indirect) with other cultural groups. Although the evidence is tenuous, the Great Oasis culture may have been involved in the Mississippian trade network as evidenced by *Leptoxis praerosa* (formerly referred to as *Anculosa*) freshwater shell beads found at the West Des Moines Burial (13PK38) and the DeCamp site cemetery (13DA64) (Henning 1991:2). There is no evidence of Great Oasis-Mississippian interaction (Tiffany and Alex 1999:89-90). If a trading relationship did exist between these groups, Mississippian-influenced artifacts would be expected in Great Oasis sites. Marine shell and Mississippian trade pottery of the Sterling phase of the Cahokia sequence (circa AD 1000-1200) (Hall 1991) have been found at the mixed Larsen site (Henning and King 1982, 1996). Henning thinks this suggests Mississippian interaction with both Great Oasis and Mill Creek. In central Iowa this is not the case (Tiffany and Alex 1999:89-90). There is no evidence for Mississippian-Great Oasis interaction. Also included as probable trade goods but of non-Mississippian affiliation or interaction were various cherts used in the production of stone tools. Non-local cherts such as those found at the Williams site (13PM50) (Williams 1975:17-20) and the Maxwell site (Doershuk and Finney 1996:17-27) are common at most Great Oasis sites. It has been postulated that the Oneota arrived in or near Great Oasis territory long after the Great Oasis people had vacated the area.

## CHAPTER 5. ENVIRONMENTAL SETTING

The location of the sites reviewed in this study and their associated environments are in part due to the landforms resulting from Wisconsinan glaciation and later Holocene deposits. The entire character of the zoology, botany, and geological resources were shaped by these events. The landforms and the biotic communities can be viewed from two complementary perspectives.

## Landforms

The study area of the Des Moines Valley in Boone and Polk Counties and the Raccoon Valley and side tributaries in Dallas and Polk Counties lie within the geomorphic system called the Central Lowlands (Mickelson 1987:111).

During the Pleistocene Epoch (1,600,000 years BP to 10,500 years BP) a series of extensive ice sheets moving in from Canada covered much of the Central Lowlands in the Upper Midwest (Prior 1991). The dating of the Pleistocene/Pliocene boundary is somewhat problematic. Some researchers push the early Pleistocene as far back as 2,500,000 years BP (Boellstroff 1978:305-6). In the study area, the Kansan and Nebraskan glacial episodes (collectively referred to as "Pre-Illinoisan") covered most of Iowa from 2,500,000 years to 500,000 years BP. The Pre-Illinoisan till and resulting landscapes of the Southern Iowa Drift Plain (Prior 1991:31) are the setting for Dallas County sites located on the south and west (right) banks of the Raccoon Rivers. The Illinoisan glacial period from 300,000 years BP to

130,000 years BP (Prior 1991:20-21) did not impact the study area directly as it was confined to the eastern extremities of Iowa.

A glacier will form when the annual snow accumulation exceeds the annual ablation (melting or calving). This is referred to as mass balance. The net balance will be zero for a glacier if accumulation equals ablation. The gravitational gradient exerted in the accumulation zone is the driving mechanism causing glacial flow (Bennett and Glasser 1996:29-34). Even if a glacier is receding, as long as there is some accumulation, a glacier will flow. Glacial flow is not only confined to aerial coverage, but also to the internal, englacial line of flow, and subglacial turbation. The patterns of flow within a glacier explain the deposition of sediments and debris carried englacially and its eventual deposition following melt out. When accumulation stops, the glacier stagnates. In an actively flowing glacier, there is subglacial deposition of debris *and* terminal moraines. A stagnating glacier will make irregular deposits as a result of melting debris-rich ice (Bettis, Quade, and Kemmis 1996:44).

The most recent glacial event in the study area of Boone, Dallas, and Polk Counties was the formation and recession of the Wisconsin-aged Des Moines Lobe (DML) reaching its maxim at about 14,000 BP (Prior 1991:36-40) (Figure 9). All the Boone County sites referenced are within the bounds of the DML. The South Raccoon River is the demarcation line separating the DML from the Southern Iowa Drift Plain and its confluence with the Des Moines River is at southern extent of the Bemis Moraine of the DML (Bettis and Hoyer 1986:21-22). Therefore, the Dallas County sites referenced are very near the southwest margin of the DML and are just outside or slightly within the bounds of the DML. The Des Moines River bisects the DML on

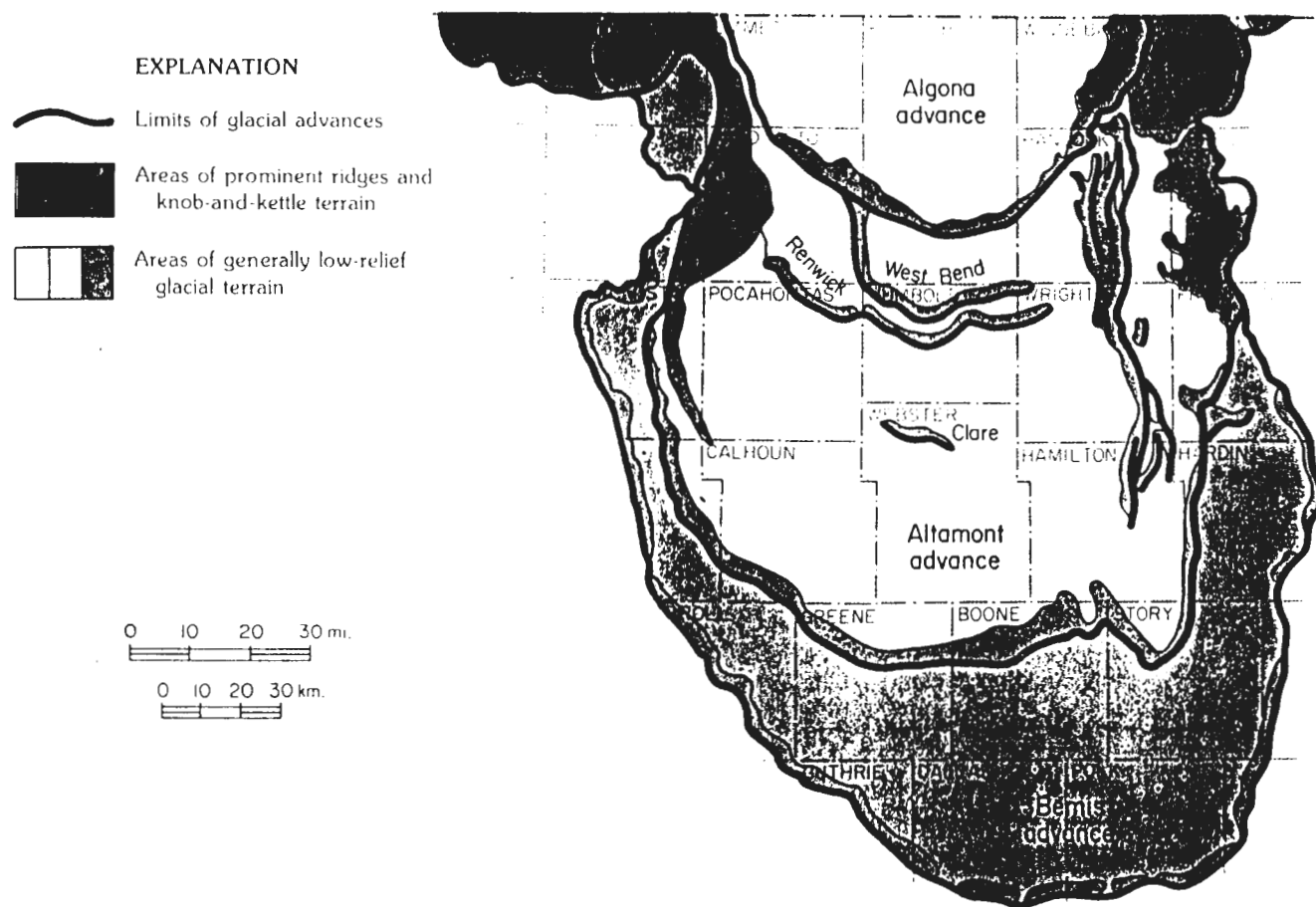


Figure 9. Glacial advances of the Des Moines Lobe (*Landforms of Iowa*, Jean Prior 1991:38).

roughly a northwest to southeast axis and is the major Iowa drainage to the Mississippi River.

The model for the Des Moines Lobe glacier has been revised. The picture of a slow-moving massive wall of ice scouring the landscape is over-simplified. Clayton, Teller, and Attig (1985) describe a pattern of a surging glacier and a rapid retreat. Kemmis (Bettis et al. 1996:42-44) provides a model of the Des Moines Lobe that more accurately explains the geomorphology and the resulting landscapes of central Iowa. Kemmis concurs with Clayton et al. (1985) regarding the surging aspects of the DML and its relative thinness, but differs in the explanation of the DML's retreat. In the Kemmis model the ice repeatedly surged and periodically stagnated. This stagnation and melt-out of debris-rich ice caused the low relief hummocky topography and the linked depression systems (Bettis et al. 1996:44) that would eventually become productive wetland habitat for waterfowl and other wildlife on the DML.

The origin of the Des Moines River is somewhat complex. During the time of its most southern advance (14,000 BP) the DML stagnated and began to recede. The glacier continued to recede for about the next 500 years until it resurged to the Altamont Moraine in northern Boone County. During this period, the proglacial melt water of the central portion of the DML was carried away by the Beaver Creek and the South Skunk River (former subglacial streams during the glacial maximum) (Bettis and Hoyer 1986:12-22). Between 13,500 and 12,600 BP the glacier again stagnated and a "sag" developed in a region that would eventually become the Des Moines River Valley. As the ice melted and precipitation events occurred, the Des Moines River Valley began to form in the study area. When the ice retreated and



resurged to the Algona Moraine, a series of high magnitude, catastrophic meltwater discharges took place that rapidly down-cut the Des Moines River Valley (Bettis et al. 1996:22-24). These events termed *jökulhlaups* (Bennett and Glasser 1996:77-80) formed the Noah Creek Formation and the characteristic Wisconsin-aged terraces of the Des Moines River Valley (Bettis et al. 1996:22-24, Bettis and Hoyer 1986:24).

The Noah Creek Formation is comprised mainly of coarse and fine gravels and sand associated with abandoned stream valleys and outwash plains (Bettis et al. 1996:22). Much of the sediment is very coarse cobbles in beds often thicker than 5 meters. Because the Noah Creek Formation can be found on outwash plains and stream channels that drained the DML, the formation can be found outside the bounds of the DML, proper (Bettis et al. 1996:22). Rock, thermally altered and otherwise, is often found in the context of Midwestern archaeological sites. It is a logical assumption that glacial cobbles and thermally-altered rock at Great Oasis component sites (e.g., 13DA264) (Doershuk and Finney 1996:86) was derived in part from outwash age deposits in the vicinity. Glacial outwash can also contain various cherts which can be used in the manufacture of lithic tools. These chert modules vary greatly in quality and serviceability as opposed to cherts quarried from beds (Morrow 1984:99). Nonetheless, the Noah Creek Formation could potentially supply some raw materials for lithic tool manufacture.

During the Holocene, the Des Moines River and the Raccoon Rivers (North, Middle, South, and Lower Raccoon) began to take on their characteristics of the time span central to this study. Of particular importance is the development of Holocene terraces and soil formation.

Holocene (beginning about 11,000 years BP) terraces are composed primarily of fine-grained loamy alluvium with lesser amounts of sandy loam and silt loam alluvium that have been deposited by meandering streams (Bettis and Hoyer 1986:32). This terrace system is collectively known as the DeForest Formation.

The Deforest Formation has seven members which include: the Flack, Woden, West Okoboji, Roberts Creek, Corrington, Gunder, and Camp Creek members (Bettis et al. 1996:26-31). The Flack Member consists of pebbly colluvium on and at the base of hill slopes derived from sheetwash. This member is distinguished from Wisconsinan Dows Formation diamictons by the pebbles within the soil matrix being of higher concentration in the lower portions and nearly absent in upper levels (Bettis et al. 1996:27). The Woden Member is a fine-grained silt found in the context of an upland depression within a linked drainage system (Bettis et al. 1996:29). This member would indicate a former wetland but is not found on or adjacent to Great Oasis sites. Therefore it is of only peripheral importance to this study. The West Okoboji Member is a fine-grained lake sediment found on the Des Moines Lobe. This member is not found on the sites of the study area. The Gunder Member is important to this study. This member "consists of oxidized, dominantly silty and loamy alluvium, colluvium and slope wash that do not have a loess cover" (Bettis 1995:12). Many of the sites in this study in Boone and Dallas Counties lie on this member. The age of this member ranges from 11,500 to 2,000 years BP (Bettis 1995:13). This member was clearly formed prior to Great Oasis occupation. The Corrington Member is stratified and is comprised of "oxidized clay loam with interbedded lenses of sand and gravel" and derived from alluvial fans where "small and



moderate-sized valleys enter larger valleys" (Bettis 1995:15). The Corrington Member can be found at Logansport, 13BN40, and on the northwest boundary of 13BN203. The Roberts Creek Member consists of a "clayey, silty, and loamy alluvium" occurring in regions where thick loess is common. The Roberts Creek Member is most commonly found in western Iowa and adjacent states (Bettis 1995:16). The Roberts Creek Member is also found on the DML and occupies the TI in most of the referenced sites (E. Arthur Bettis III, personal communication 1999). The Camp Creek Member (formerly referred to as "post settlement alluvium") is recent silt loam to clay loam and can overlie other DeForest Formation members (Bettis 1995:17). In the study area, this member generally occupies the lowest elevation of the modern flood plain.

A terrace is the location of a former floodplain. As alluvium accumulates in a valley floor, the floodplain develops. When the stream or river downcuts through this alluvial plain, the resulting escarpment above the stream is a terrace (Prior 1991:135). Bettis and Hoyer (1986:32-33) use a three-tier system to describe these terraces. These terraces are separated by 1-3 meter scarps. The High Terrace (TH) was laid down by episodic flooding about 11,000 to 4,000 years BP. Most of the Great Oasis component sites (excluding burials) are on or partially on High (Gunder Member) Terraces. Intermediate (most commonly Roberts Creek Member) Terraces (TI) developed between 4,000 and 750 years BP. This chronology supports Gunder Members at the Intermediate Terraces also. The Low Terraces (TL) represent the modern floodplain and developed after 750 years BP. This final level requires some clarification for this study. The Great Oasis culture would pre-date the TL. A plausible explanation regarding the

floodplain utilized for Great Oasis horticulture can be offered. The floodplain used by the Great Oasis people was probably slightly closer in elevation relative to the existing river at that time than the modern floodplain and therefore be subject to more flooding. It can be assumed that the amount of potentially tillable land of the intermediate terrace combined with that of the floodplain during the Great Oasis period of occupation is roughly equal to the recent United States Department of Agriculture Soil Surveys. This position is taken because the landforms that constrain the Des Moines and Raccoon Rivers were in place at the time of Great Oasis occupation. This TL does of course contain some historic alluvium of the Camp Creek Member of the DeForest Formation. The Boone and Dallas County Soil Survey maps show developed soils at TL in some cases. Bettis (personal communication 1999) points out that in some TL alluvium may be underlain by soils that present developed soil profiles. Camp Creek deposits can overlie older deposits (Mandel 1996:5-6) which may contain Great Oasis components. The Gunder Member is generally a high to intermediate terrace with its age range from 10,500 to 3,000 BP (Mandel 1996:5) following Bettis's chronology. (See Appendix.)

In summary, the landforms at or near Great Oasis sites of the study area show some common elements. Habitation zones are on the middle and high terraces of major water courses, with the active alluvial plains in the valleys. These alluvial plains are represented by the low terrace which in-part was used for cropping. The valley walls were steep-sided that yielded to gently rolling uplands with productive wetlands.

## Soils

Paton, Humphreys, and Mitchel (1995:2) cite the United States Department of agriculture (USDA) (1938:948-992) in which: "According to this, soil is produced over time by the action of climate and living organisms upon parent material, as conditioned by local relief, which results in the formation of zonal, intrazonal or azonal soils."

The soils found on and adjacent to the DML were derived from various sources such as local bed rock, Wisconsinan and Pre-Illinoisan glacial till, loess, and older soils that have undergone weathering and deposition over time. The climate of the study area has undergone significant changes since the last glacial episode from cool and damp promoting conifer vegetation to dry to the current moist conditions which promote mixed forests and prairie vegetation. These climatic changes are most pronounced by amounts of precipitation. Relief effects runoff and percolation. The relief of the study area ranges from gently sloping uplands to steep side slopes of river valleys to nearly level alluvial plains (Dideriksen 1983:92-94).

This brief summary of general soil associations include those soil types within a 1-kilometer radius of Great Oasis sites. This includes valleys and terraces, side slopes, and uplands. A more thorough description of individual soil units in the Boone, Dallas, and Polk Counties study areas is given in Chapter 7. Nearly all Great Oasis habitation sites in this study are in alluvium. Therefore, the soils on or near Great Oasis sites reflect terrace complexes on which those habitation sites are located. The constituents of those soils depends on the location of the site (on or off the Des Moines Lobe), the climate, and vegetation under

which the soils developed. The soils in context to sites along the Des Moines River are generally till-derived due to the recent glaciation of the DML. The soils of the Lower Raccoon River Valley locality reflect outwash from the DML and older till from the Southern Drift Plain. The soils south of the Raccoon River in this locality also have a higher loess content than those in association with the DML.

The soils of the Boone County study area (Noah's Bottom locality) on which Great Oasis sites are located, or are adjacent to, fall primarily in the Buckney-Moingona-Sattre association (Andrews and Dideriksen 1981: General Soil Map). These soils are "nearly level to moderately sloping, excessively drained, and well drained, loamy soils on bottom lands, alluvial fans, foot slopes and stream benches" (Andrews and Dideriksen 1981:8).

The soils of the Dallas County study area (Lower South Raccoon Valley locality) are decidedly more complex than the Boone County study area. This is partly due to the Raccoon River being the line of demarcation between the older Southern Iowa Drift Plain and the more recent Des Moines Lobe (Prior 1991:32, 36, 64-66). The soils of the valleys in the Dallas County study are primarily (although not exclusively) alluvial bottom land soils. The following associations are generalized and there is some overlap and some anomalous soil types within these associations. In the upper limits of the Lower Raccoon locality (the confluence of the Middle and South Raccoon Rivers) the major soil association is Coland-Hanlon-Wadena which is "nearly level to gently sloping, poorly drained, moderately well drained, loamy soils that formed in alluvium on bottom land and stream terraces" (Dideriksen 1983: General Soil Map). In the area on the south terraces and

valley floor along the South Raccoon below the confluence of the Middle and South Raccoon Rivers, the main soil association is Ladoga-Lindley. This association is "gently sloping to very sleep, moderately well drained and well drained, silty soils that formed in loess and glacial till on uplands" (Dideriksen 1983: General Soil Map). In the same reach of river valley on the north side of the South Raccoon River is the Hayden-Storden-Lester association. This generalized association is "gently sloping to very steep, well drained, loamy soils that formed on glacial till on uplands" (Dideriksen 1983: General Soil Map). In the area down stream to the east at the confluence of the North and South Raccoon Rivers the main soil association on both sides of the river valley is Nodaway-Wiota-Colo. This association is "nearly level to very gently sloping, moderately well drained and poorly drained, silty soils that formed in alluvium on bottom land and stream terraces" (Dideriksen 1983: General Soil Map).

### Climate

Botanical specimens in the form of charcoal and carbonized seeds can be an indication of climatic conditions. In the Noah's Bottom and Lower South Raccoon River localities, botanical analysis was completed at Meehan-Schell (13BN110) (Mead 1981) and Maxwell (13DA264) (Doershuk and Finney 1996). Seed analysis was performed at both sites and some charcoal was attributed to particular species. Charcoal was also analyzed from Kuehn (13DA110) (Doershuk and Finney 1995). Examples of botanical specimens recovered at Kuehn include *Zea mays* (maize), *Chenopodium* (lambs quarter, goosefoot), *Polygonum* (knotweed), and *Carya ovata* (shagbark hickory) (Green 1995:16). Examples of plant remains at recovered at nearby Maxwell include *Chenopodium berlandieri*, *Juglans nigra* (black walnut), *Corylus americana*



(hazelnut), and *Helianthus annuus* (common sunflower) (Asch 1996:29-35). Similar botanical specimens were found at Meehan-Schell. Some examples include *Cucurbita pepo* (squash or pumpkin), *Zea mays*, *Chenopodium*, *Helianthus annuus*, and *Juglans nigra* (Mead 1981:39-47). Although not a complete list of all botanical specimens recovered, the aggregate gives a broad indication of growing conditions. In the study area today, all these examples are easily grown. Of 17 listed *Chenopodium* species in Iowa (Eilers and Roosa 1994:80-81) only four are native and of those only *Chenopodium berlandieri* and *Chenopodium standleyanum* are common in the study area today. This gives the impression that the climate experienced by the Great Oasis culture was not greatly different than the current climatic conditions in the study area. Semken and Falk (1987: 200-1) describe the climatic regime at that time as the Neo-Atlantic climatic episode and "having similar amounts of rainfall to that of today."

A climatic analogy for the study area can be drawn by using contemporary climatic records. The Natural Resource Conservation Service (NRCS) (formerly the Soil Conservation Service [SCS]) has given climatological data in their county soil surveys (Andrews and Dideriksen 1981, Dideriksen 1983). Updated climate data for Boone County has been gathered by the Midwestern Climate Center of Champaign, Illinois. Updated climate data for the Lower South Raccoon River locality and the Walnut Creek locality have been taken from the former National Weather Service installation at the Des Moines International Airport. These data were also compiled by the Midwestern Climate Center. The latitude of the Des Moines International Airport is 41°32'30". Both the Walnut Creek locality and the

Lower South Raccoon River locality are a mere 3.5 kilometers north from this latitude.

The Noah's Bottom locality has a north-south orientation along the Des Moines River. The most northerly site is Logansport (13BN103), positioned at slightly south of  $42^{\circ}5'$  (which is also the latitude of current Boone, Iowa). The most southerly referenced site is Hubby (13BN38) which is positioned at approximately  $41^{\circ}56'$ . The lineal distance in latitude between these sites is approximately 16 kilometers. The mean annual temperature for Boone, Iowa, is  $8.67^{\circ}\text{C}$  ( $47.6^{\circ}\text{F}$ ) for 1961 through 1991 (Midwestern Climate Center 1999). Overall, in the city of Boone in 10% of years, the last frost of the season can be expected no later than 14 May and the first frost of the fall can be expected by 20 September. In the mean growing season the last frost can be expected by 2 May and the first frost of the fall by 3 October yielding an average growing season of 156 days (Midwestern Climate Center 1999). The mean annual precipitation from 1961-1990 for Boone County was 87.66 centimeters (34.51 inches) falling mainly in the spring and summer months as rain (Midwestern Climate Center 1999).

The recent climatological data for the Lower South Raccoon River locality and the Walnut Creek localities are given collectively because the same point source for data collection (Des Moines International Airport) has been used by the Midwestern Climate Center. At this location, from 1961 through 1990, the mean annual temperature is  $9.94^{\circ}\text{C}$  ( $49.9^{\circ}\text{F}$ ) and the mean annual precipitation is 84.12 centimeters (33.12 inches). During that period, in 90% of years, the last frost of the spring season can be expected by 5 May with the average being 21 April. The first frost of the

fall occurs on average on 12 October. This yields an average growing season of 174 days (Midwestern Climate Center 1999). Modern climatological data would indicate the current Boone County study area is slightly cooler and wetter than the more southerly Dallas and Polk County study areas. There is an eight day differential in growing season length between the Noah's Bottom and Lower South Raccoon River localities. If these modern data can be extrapolated to the context of the Great Oasis occupation of the study area, the different localities would have more or less the same climate but with some variabilities in weather extremes. These minor climatic differences probably would not be significant enough to create marked differences in the local flora and fauna or the crops selected for Great Oasis horticulture.

According to Bryson, climate can change quickly and significantly with only small changes to climatic variables (1974:759). As Baerreis and Bryson purport (1965:215-217), there is sufficient evidence to presume that the warm, moist Neo-Atlantic weather regime lasted from circa AD 800 through approximately AD 1250. This was followed by the cooler and drier Pacific Climatic Episode. Circa AD 1450, the climate appears to have returned to conditions similar to the Neo-Atlantic. At about AD 1200 the "rain shadow" caused by the Rocky Mountains began to extend further eastward across the Great Plains and prairies (Lamb 1995:209-210). Bryson developed a weather pattern model based on hemispheric zonal air flow. In this model the warm, moisture laden sub-tropical summer air flow emanating from the Gulf of Mexico was replaced by strong, cooler, and drier Westerlies (Bryson 1968:1-9). The climatic pattern eventually reverted back to its former character.



## Prairie Peninsula

The study area of Boone, Dallas, and Polk Counties of central Iowa are within the Illinoisan biotic province as defined by Dice (1943:5,21-23). This large region encompasses far southern Manitoba, eastern North and South Dakota, eastern Nebraska, southwestern Minnesota, southern Wisconsin, northern Illinois, northern Missouri, and all of Iowa. Dice describes this province as "an extensive area in the upper Mississippi Valley over which prairie and deciduous forest alternate" (1943:21). The "Prairie Peninsula" as defined by Transeau (1935) is more commonly referred to in literature and includes mixed deciduous forest and tall grass prairie in a wedge through Iowa, Illinois, Indiana, and Ohio. Fire is a regulating factor in the prairie peninsula biotic community. Due to intermittent burnings, the various plant communities will not reach a "climax" state unless the effect of fire is removed for an extended period of time. These plant communities are referred to as *disclimatic*. Perennial plants in these biotic communities have specialized adaptations to store nutrients below ground for regeneration following disturbance by fire (Danielle M. Wirth, personal communication 1999).

## Prairie

It is beyond the scope of this study to give an in-depth description of the prairie biome in central Iowa, as all Great Oasis components in this study were located in valleys within what is understood to be gallery forest conditions. There may have been an association of the Great Oasis people with the tall grass prairies nearby, but it cannot be found directly in the archaeological evidence, only inferred. The Low Village site (21MU2) in southwest Minnesota is located on a former prairie lake (Henning

1971:124; Wilford 1942:23) but this type of Great Oasis settlement is not found in the central Iowa study area.

Prior to Euro-American settlement, the rolling tall grass prairie was the dominant vegetation of Iowa. It is estimated the entire Prairie Ecosystem in Iowa was approximately 30 million acres of which only 0.02% remains today (Smith 1981:7). The combination of soil types, topography, rainfall, evaporation, and the intermittent presence of fire have maintained the tall grass prairie ecosystem over the past 10,000 years (Smith and Christiansen 1982:163). On the Des Moines Lobe the warm season grasses such as big bluestem (*Andropogon gerardi*), Indian grass (*Sorghastrum nutans*), and prairie dropseed (*Sporobolus asper*) comprise most of the biomass on the well drained upland sites. In the dryer areas, little bluestem (*Andropogon scoparius*) and sideoats gramma (*Bouteloua curtipendula*) dominate. Additional grass species are found in wet soil conditions (Smith and Christiansen 1982:166). The inventory of the less dominate prairie forbs is extensive. The tall grass prairie of Iowa in general supports approximately 400 species of grasses and forbs (Thompson 1992:20).

#### Oak Savanna

The oak savanna is a unique habitat that is characterized by bur oaks (*Quercus macrocarpa*) or white oaks (*Quercus alba*) that are spaced distantly enough to not form a canopy but allow for an understory of prairie vegetation. This community appears to be maintained by fire, but to a lesser extent than the true prairie. The dominant savanna trees are fire adapted with thick corky bark. In current-day forests in the study area, indications of former savannas can be found. These former savannas can be

located by observing the spacing of large oaks with a pattern of more uniformly aged smaller trees encroaching beneath (Thompson 1992:48). Remnant savannas can be found today in the study area where the oak-hickory forest yields to upland farm fields (former tall grass prairie). Specifically, there are indications of former savannas upslope and to the west of 13BN203 and upslope and south of Meehan-Schell (13BN110) and Noah Creek Kiln (13BN111). Although the documented evidence is lacking, oak savannas may have provided elk habitat exploitable by the Great Oasis people. The very large and widely spaced oaks overlooking the Middle Raccoon River near Redfield, Iowa, give the same indication of a former savanna habitat.

An additional speculative indication of savanna habitat is soil types. Certain types of soil units indicate the former dominant vegetation before mechanized agriculture. These would include grasses (former prairie), trees (former or current forest), and transitional types showing characteristics of both (Andrews and Dideriksen 1981:81). These transitional soil types and their location between prairie and forest soils indicate probable former savanna areas. In Boone County these types are Lester (236B,C), and LeSueur (325) (Andrews and Dideriksen 1981:81). As examples, these soil types are within 2 kilometers of Meehan-Schell (13BN110), Noah Creek Kiln (13BN111), and 13BN203 as mentioned in the previous paragraph (Andrews and Dideriksen 1981:Sheet Number 46,60). In Dallas County, LeSueur (325), Ladoga (76B,C,D2), and Gara (179F, 993D2) indicate transitional conditions of forest and prairie (Dideriksen 1983:93). As examples, these soil types are within 2 kilometers of the

Maxwell site (13DA264), Windmill Village site (13DA112), Keufner site (13DA126), and 13DA37 (Dideriksen 1983: Sheet Number 65, 66, 72).

### Forests

Based on the assumption that the climatic conditions of the study area are roughly analogous to those of the 20th century, and the mapped vegetation of Iowa in the 19th and 20th centuries is similar to the environmental conditions during Great Oasis occupation, a discussion of historic forest environments can be generalized to the Great Oasis culture. As noted, floral analysis of Great Oasis site features have identified tree species common today in the study area.

At the time of Euro-American settlement, approximately 18% of Iowa was forested (Van der Linden and Farrar 1984:3) lying predominantly in the eastern and southeastern portions of the state and along the major streams and rivers elsewhere in the state (Iowa State Planning Board 1935: Figure 16). See Figure 10.

Five different forest communities are represented in Iowa as described by Van der Linden and Farrar (1984:4-5), four of which are within the context of Great Oasis occupation in the study area. A brief synopsis is as follows.

1. The *oak-hickory* community is mainly on well-drained uplands and south and/or west facing slopes. In the central Iowa study area, the mature forest canopy is dominated by bur oak (*Quercus macrocarpa*) (Van der Linden and Farrar 1984:4), white oak (*Quercus alba*), northern red oak (*Quercus borealis*), shagbark hickory (*Carya ovata*), and white ash (*Fraxinus americana*) (Aikman and Smelser 1938:143). The understory layer has an assortment of smaller trees such as ironwood (*Ostrya virginiana*),

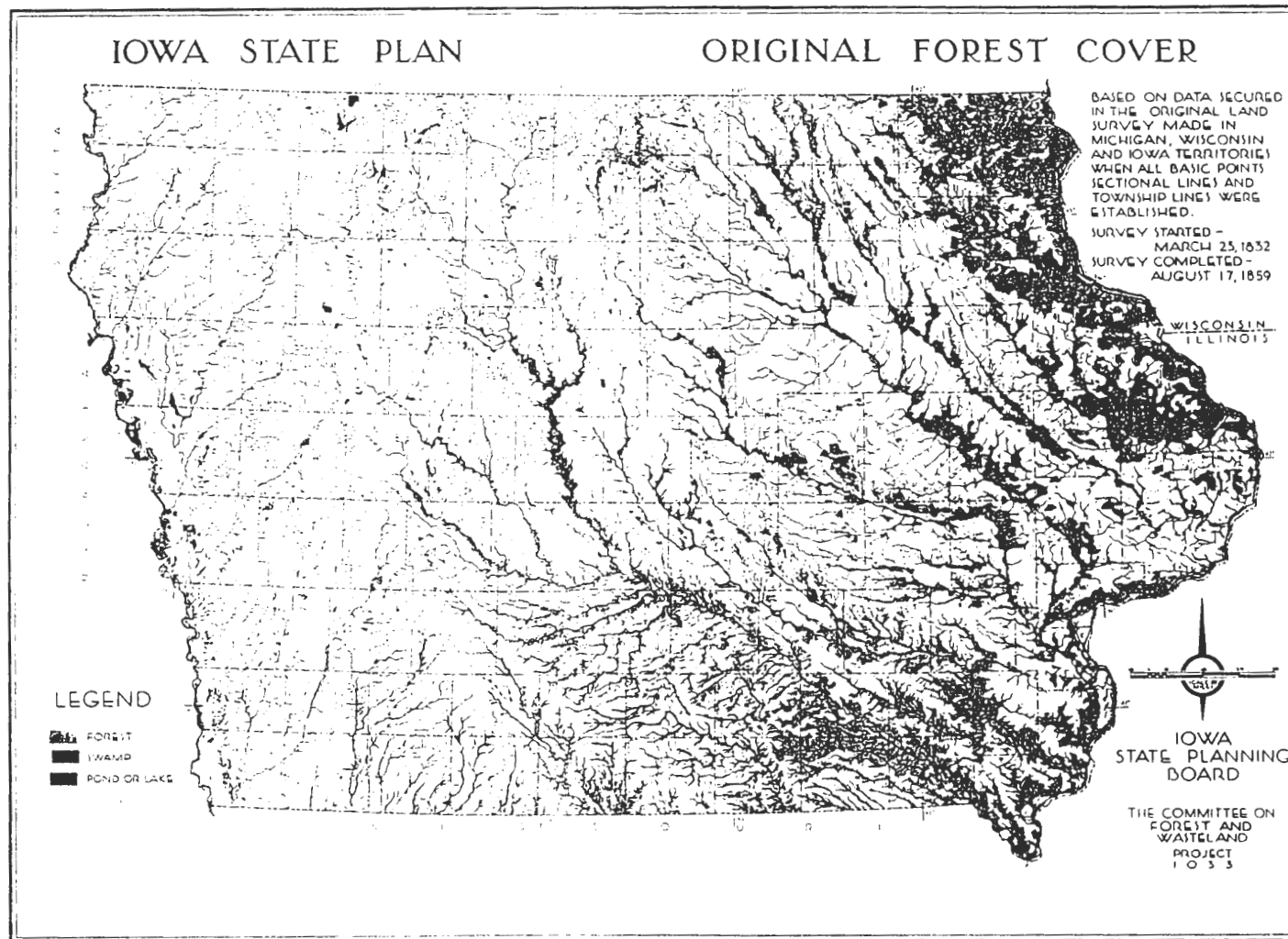


Figure 10. Iowa State plan. Original forest cover (Iowa State Planning Board, Figure 16).



chokecherry (*Prunus virginiana*), and saplings of the larger dominant trees. In clearings or along edges of this community, shrubs can dominate. Shrub examples include hazelnut (*Corylus americana*), prickly ash (*Zanthoxylum americana*), and gray dogwood (*Cornus foemina racemosa*). This community provides a variety of acorns of varying quality and hickory and hazel nuts for potential human consumption. Hickory and hazel nut fragments were recovered at the Maxwell Site (Asch 1996:31). This forest community also attracts deer and (and probably black bear in earlier times) when acorns are in season, and provides habitat for animals such as squirrels and wild turkey. When growing in thick stands, gray dogwood saplings are straight with few side branches. For its size, the wood of the gray dogwood is strong and dense and could have been a readily accessed source of arrow and tool shafts.

2. The *oak-maple-basswood* community dominates the well-drained north and east facing slopes and terraces of forested areas in stream and river valleys. This community tends to have a higher ambient moisture level than the oak-hickory due to its exposure away from the strongest direct sunlight. In the study area the canopy is dominated by hard (black) maple (*Acer nigrum*), northern red oak (*Quercus borealis*), and basswood (*Tilia americana*). Basswood provides a high quality fibre that can be used in the manufacture of cordage and its wood is easily carved. Interspersed among the dominant trees include black walnut (*Juglans nigra*), butternut (*Juglans cinerea*), formerly American elm (*Ulmus americana*) and other less dominant ashes and oaks. Black walnut and butternut are both examples of potential food resources. Evidence of *Juglans* was recovered at Meehan-Schell (Mead 1981:57) and Maxwell (Asch 1996:31). Examples of tree species in the

understory layer include ironwood and hard maple saplings, gray dogwood, and service berries (*Amelanchier arboria*). Service berries provide a sweet fruit and can be a potential human food source if harvested before being eaten by birds.

3. The *bottomland hardwoods* community is generally found on low or intermediate terraces and floodplains of the study area. Examples of species represented in the canopy layer include silver (soft) maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), hackberry (*Celtis occidentalis*), black walnut, and cottonwood (*Populus deltoides*). The understory level if unmodified by human activity is usually densely growing saplings of the dominant trees. This forest community is in the closest proximity to Great Oasis sites and probably supplied the majority of their wood resources. Although this community does not provide high quality wood resources by today's standards, the wood was readily available to the Great Oasis people and soft enough to gather by hand or by the use of stone tools.

4. The *riparian* community is a continuation of the bottomland hardwood community on the banks and sandbars of rivers and streams, and along wetlands and lakes. Examples from this community include box elder (*Acer negundo*), cottonwood, silver maple, and willows (*Salix spp.*). As the location for this community is usually wet and prone to flooding, pioneer plant species tend to inhabit this area.

5. The final community described by Van der Linden and Farrar is the *northern conifer-hardwoods*. This community in Iowa is confined to the northeast and is outside the central Iowa study area.

## Fauna

This section has not been designed as an exhaustive list of Iowa fauna but rather an attempt to highlight the former biodiversity of the study area. Again, when considering environmental modeling during Great Oasis occupation, modern analogies must be drawn. This is especially true when modeling wildlife inventories for the study area. As noted, nearly all Great Oasis sites are mixed, containing elements from various cultural horizons. Unless the context of a faunal element is precisely known, an environmental model based on that artifact(s) can only be general in nature. According to historic documentation, Iowa once was abundantly endowed with wildlife (Bowles 1981, Dinsmore 1994). At the time of initial Euro-American settlement, Iowa had species totals of approximately 68 mammals, 186 birds, 45 reptiles, 21 amphibians, and 136 fish (Dinsmore 1994: 3). These figures include all habitats across the state but do give some picture of the faunal biodiversity due to the close association of the forest, savanna, prairie, and water resources of the study area.

Faunal evidence within the archaeological context is not particularly strong at Great Oasis sites in the study area (Morrow et al. 1999:17). Gradwohl (1974) reports evidence of deer, beaver, fish, turtle, and freshwater mussels at Great Oasis site in the study area along the Des Moines River. By contrast, Great Oasis sites in northwest Iowa have extensive faunal inventories. An example is the Cowan site (13WD88) (Morrow 1999). There are no detailed faunal analyses at any of the sites referenced in this study. Very small fragments of calcined bone are frequently recovered in excavations at Great Oasis sites but are so diminutive that conclusive species identification cannot be determined. Ungulate teeth



tentatively identified as white-tailed deer or elk are occasionally found at Great Oasis sites in the study area. This lack of a complete faunal assembly is due to several factors. Bone preservation on the terraces of the study area is poor due to the general acidic soil pH (Andrews and Dideriksen 1981, Dideriksen 1983). There is an absence of deep refuse middens associated with Great Oasis sites in central Iowa which may be partly due to cultural practices such as scattering the refuse for camp dogs to scavenge (Ritzenthaler and Ritzenthaler 1970:21). Other examples might include processing game away from the habitation area or not determining a communal point of refuse deposit. Since Great Oasis sites in the study area do not appear to be compacted within fortifications, the inhabitants may have been more inclined to carry their refuse away or allow scavengers to carry it away. Refuse deposits at Great Oasis sites tend to be thin sheet middens. Faunal assemblages have been analyzed at Great Oasis sites in northwest Iowa and South Dakota but these sites were under drier prairie conditions with less forest. Thus, the comparison can only be an approximate analogy. Styles (1981) gives a cautionary note regarding prehistoric faunal population models. She contends modern ecological studies are "biased by changes in faunal composition brought on by habitat destruction, the provision of agricultural food products, species extirpation, the elimination of large predators, and the introduction of nonnative species" (1981:79-80). Rather than contend with vague and undefendable prehistoric faunal population estimates, Styles limits her analysis and discussion to fauna of "potential economic importance" (1981:80).

In the following sections only those fauna with the highest potential economic value will be highlighted. Predators such as wolves, coyotes, bobcats, mountain lions, bears, and badgers have been recorded historically and were probably available to the Great Oasis people. The analysis of faunal remains at the Cowan site (13WD88) gives some indication of the diversified utilization of fauna by the Great Oasis people (Morrow et al. 1999:305-308). This site is to the northwest of the study area and the inhabitants had access to a drier, more prairie-like environment from the gallery forest of the Missouri floodplain. It is interesting to note the rather high relative frequency of dog or coyote found at this site. Waterfowl remains are also prominent in the faunal assembly at Cowan due to its location on the Missouri flyway. The linked depression drainage system of the Des Moines Lobe and the drainage patterns of the Southern Iowa Drift Plain in the study area would have been equally highly productive habitats for various waterfowl. Fur bearers would probably have had some economic value for food and pelts but their evidence is meager and their densities cannot be determined from the archaeological data.

### Fish

With the exception of the Des Moines River, the headwaters of all rivers and streams of the study area have their headwaters on the Des Moines Lobe (Harlan and Speaker 1987:6). At the time of Euro-American settlement, apparently the inland waters of Iowa were teeming with fish as 19th century documentation attests (Call 1890-1891; Meek 1889; Menzel 1981). Examples of those fish once found or currently residing in the study area of potential economic value to the Great Oasis people would include: catfish (Ictaluridae); suckers, buffalo, carpsuckers, redhorses

(Catostomidae); northern pike (*Esox lucius*); largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and various sunfish species (Centrarchidae); and walleye and perch (Percidae) (Harlan and Speaker 1987; Meek 1889). Fish with predictable spawning runs such as shad and eels probably played some role in the Great Oasis economy.

Possible evidence of fishing playing an important role in the Great Oasis economy in the South Raccoon River Locality has been recovered from the DeCamp Burial (13DA64). Several bone fish hooks were recovered from this location and are curated at Iowa Historical Society Museum in Des Moines. Three bone fish hooks (I 4577.40, 41, 42) were carved from what appears to be cervid metapodials. The shafts of these hooks are straight and without proximal bulbs for attachment to lines. Specimen I 4577.41 is representative of this set. This fish hook is 27.18 mm long and 15.54 mm at its widest point. It is 4.10 mm thick at its maximum. An unusually large bone hook (I 4577.30) was also recovered at the DeCamp Burial site. Its overall dimensions were 96.83 mm in length and 51.69 mm between the hook tip and the shaft. The cross-section of the shaft at its thickest point measures 11 mm. If this implement was intended for functional use, it would be for extremely large fish by today's standards. Since this hook was recovered in the context of other grave goods, it may have served a symbolic function rather than one of utility.

#### Avifauna

There is very little evidence of the use of birds in the Great Oasis economy due to the soil acidity and the fragility of avian bones. Birds are an accurate reflection of overall biodiversity in a given locality or region (Jackson, Thompson, and Dinsmore, et al. 1996:11-16).

In the study area of central Iowa, the variety of bird habitats in the vicinity of Great Oasis sites is impressive. Prior to large-scale settlement and modern agriculture and the subsequent habitat loss, the prairies, savannas, forests, and wetlands would have supported extensive bird populations (Jackson et al. 1996:31-37). The flyways of migratory birds (including waterfowl) converge in the prairie peninsula forming seasonal avian "bottlenecks" (Scott 1958:193). An early compilation of birds occurring in central Iowa tallied 289 separate species for Polk County (DuMont 1931). Numerous migratory waterfowl in the form of ducks and geese (including their eggs as human food source) would have been found along the waterways and the upland wetlands. These would have provided a predictable food source on a seasonal basis. Resident species such as the greater prairie chicken (*Tympanuchus cupido*) (Ehresman et al. 1996:130-131; Stemple and Rogers 1961) and the wild turkey (*Meleagris gallopavo*) would have been available to the Great Oasis people. Currently the wild turkey has a density of approximately 20-30 per square mile in the forested regions of central Iowa (Ehresman et al. 1996:132).

#### Mammals

Iowa once had extensive populations of larger mammals that could have been exploited by Great Oasis people such as bison (*Bison bison*), elk (*Cervus elaphus*), white-tailed deer (*Odocoileus virginianus*), bobcat (*Lynx rufus*), mountain lion (*Felis concolor*), black bear (*Ursus americanus*), wolf (*Canis lupus*), coyote (*Canis latrans*), red fox (*Vulpes fulva*), gray fox (*Urocyon cinereoargenteus*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethica*), raccoon (*Procyon lotor*), and river otter (*Lutra canadensis*) (Dinsmore 1994). There is virtually no direct evidence of bison at Great

Oasis sites in central Iowa, however, bison remains are common at Great Oasis sites in northwest Iowa (Morrow 1999:17). Collectors continue to recover bison bones and elk bones and antlers along Beaver Creek near the Dallas and Boone County border. These remains are out of context yet give some indication of the former potential of the area to support large game animals.

### White-tailed Deer

White-tailed deer remain relevant to this study because of the potential economic value to the Great Oasis people. Deer would be a renewable supply of protein, hides, bones, and antlers for tools, and sinew for cordage.

The approximately 30 subspecies of the white-tailed deer can be found throughout the continental United States from the east to west coasts, southern and central Canada, Mexico, and Central America. Due to habitat loss and herd destruction in the United States, many white-tailed deer were live-trapped and shipped great distances for restocking and management programs. Therefore, in the east and central United States, subspecies determination is currently unclear because of interbreeding (Bauer 1993:8-25). The most probable native white-tailed deer (plains white-tailed deer) in Iowa was *Odocoileus virvinianus macrourus* (Scott 1937:88-91). Some of the foundation stock for the re-introduction of white-tailed deer in central Iowa in the early twentieth century came from Minnesota from the *O. v. borealis* subspecies (Scott 1937:90-91). The ancestral range of the plains white-tailed deer was west of the Mississippi River, from southern Minnesota to central Louisiana with eastern portions of South Dakota, Nebraska, Kansas, Oklahoma, and Texas (Bauer 1993:9). The average gestation



is 200 days. The young doe generally produces a single fawn but twins are common in mature does (Whitaker and Hamilton 1998:536).

The weights of white-tailed deer vary considerably by age, sex, and habitat. Larger white-tailed deer generally occur in northerly areas of the United States and Canada. The weight of bucks range from 69 to 141 kg (150-310 lb.). Today a buck white-tailed deer is seldom larger than 90 kg (200 lbs.). Does are proportionately smaller and weigh 41-96 kg (90-210 lbs) (Whitaker and Hamilton 1998:532). As an example, a buck butchered by the author in December of 1998 from Cass Township of Boone County had an approximate live weight of 82 kg (180 lbs), a field dressed weight (minus the hide, head, and internal organs) of 68 kg (150 lbs) and yielded approximately 36 kg (80 lbs) of de-boned meat. This is a close approximation of 39 kg on average of "usable meat" per deer as determined by Watt and Merrill (1963:Table 1).

White-tailed deer in general are highly adaptable. This enables them to exploit varied habitats. White-tailed deer thrive in vegetation of mixed successional stages and forest clearings (Whitaker and Hamilton 1998:532-3). The varied vegetation of the Noah's Bottom and Lower South Raccoon River localities would have provided superior habitat for white-tailed deer. White-tailed deer will browse, graze, and eat fruit and acorns when available (Whitaker and Hamilton 1998:535). These food sources can be found at different elevations relative to the rivers in the study area. This indicates some amount of mobility by deer on a daily feeding round. This pattern of predictable movements by white-tailed deer continues at present in the study area.

Developing a model for white-tailed deer populations during the time of Great Oasis occupation of the study area is speculative, at best. Due to the devastating winter of 1856-57 and unregulated hunting, white-tailed deer in Iowa were virtually extinct by 1900. Some isolated captive herds existed which were in part the foundation stock for deer recovery programs (Dinsmore 1994:34-36). Due to the proximity of a released, once-captive herd at Ledges State Park to Iowa State College (University) the white-tailed deer populations were studied through the 1930s, 1940s, and 1950s during the herd's recovery phase (Buxton 1951; Salinas 1948; Schmidt 1962; Scott 1937). Their data reflect a period in which the deer population was only beginning to recover. Their data also are taken from the context of close proximity to modern agriculture. The availability of corn in a white-tailed deer's diet reduces the probability of winter kill due to starvation. The suppression of fire has increased the amount of low-growing browse available to deer. In addition, these studies were conducted in the absence of predators. This places these studies open to interpretation regarding the native populations of deer. What these studies do show is the high fertility rate and adaptability to white-tailed deer living in proximity to humans. The success of white-tailed deer recovery has been so pronounced, in some locations in Iowa, they have exceeded the local carrying capacity and in some places are considered a nuisance (Dinsmore 1994:41).

The population density of white-tailed deer vary with the amount of food available. The highest density of white-tailed deer can be found in eastern United States' bottomland hardwoods. These areas can support as many as 25 deer per square kilometer (64 per square mile) (Whitaker and

Hamilton 1998:537). In the harsher climate of the Midwest this figure may be lower than that given by Whitaker and Hamilton. The approximate 1959 density given for the Boone County Hubby site (13BN38) area given by Schmidt (1962:174) was only 3 deer for the 1-kilometer site-catchment. In that year the entire Boone County had only an estimated 58 deer with 125 and 65 in Dallas and Polk Counties, respectively (Schmidt 1962). Clearly, these figures are much lower than what would be expected in the period of Great Oasis occupation.

During January of 1996, 1997, and 1998 The United States Army Corps of Engineers and the Iowa Department of Natural Resources conducted joint deer censuses by means of aerial spotting from a helicopter. This census was conducted in a 48 square mile (124 square kilometers) area in northern Polk County in the vicinity of Saylorville Lake in timber and brushy habitats. Snow on the ground aided in making the deer visible to the spotters. These counts were completed following the deer hunting season in which a 50% harvest is estimated. The 1996 count yielded 13 deer per square mile (5 deer per square kilometer). The population increased to 27 deer per square mile (approximately 10.4 deer per square kilometer) in 1997 and continued upward to 32 deer per square mile (approximately 12.36 deer per square kilometer). In this habitat, wildlife biologists contend that the upper limit of sustainable deer populations is between 20 and 30 deer per square mile (8 to 12 per square kilometer). This does consider supplemental food forage by deer from agricultural fields (Scott Rolfes 1999, personal communication). For the purposes of this study a conservative estimate of 8 deer per square kilometer (20 per square mile) for a stable population will be accepted.



## Elk (Wapiti)

Like the white-tailed deer, elk (also referred to as wapiti) (*Cervus elaphus*) probably had some significant part in the Great Oasis economy although there is no archaeological evidence in the study area to verify this. Whereas modern white-tailed deer herds can be observed for behavioral patterns in the study area, this is not the case regarding elk. There are currently no free-ranging elk in the study area. Historic and ethnographic references coupled with modern elk studies in the western United States are all that are available to model prehistoric elk populations. These combined sources can only give a general picture of elk populations and behavior in the study area during Great Oasis occupation.

The geographic distribution of elk in the United States and Canada showed a similar, but slightly more restricted range than the white-tailed deer. Elk were once numerous throughout Iowa but were predominantly in the grasslands of the western two-thirds of the state (Dinsmore 1994:25). Like the white-tailed deer, the severe winter of 1856-1857 was disastrous to the elk population. Coupled with unregulated hunting and habitat loss, elk populations never recovered in Iowa. Elk were extinct in Iowa by 1871 (Dinsmore 1994:28).

Elk are significantly larger than white-tailed deer. The average weight of a bull elk is approximately 261-450 kg (580-1,000 lbs) and the cows elk are slightly smaller weighing on average from 225-293 kg (500-650 lbs) (Whitaker and Hamilton 1998:522). The reproductive rate (like white-tailed deer) is controlled by available food resources, weather, and predation. The overall reproductive capacity for elk is less than that of the white-tailed deer. Elk cows take longer to mature than white-tailed

deer and reach the highest level of reproductive potential at 4-6 years. The gestation of elk is from 247-262 days (Bubenik 1982:169-171) which is a full month longer than white-tailed deer. Twinning is a relatively rare occurrence among elk (Taber, Raedeke, and McCaughran 1983:280).

Modern studies show elk are opportunistic foragers. They are an ecotone species preferring the edges of forests with adjacent openings. The forested areas are used for cover from weather (wind break in winter and shade in summer) and the nearby grasslands provide necessary grazing. The ecotone has the greatest variety of plants for the elk to exploit (Skovlin 1982:388). These studies are of existing elk herds in mountainous areas of the western United States and Canada and therefore are only a rough analogy. The grasslands subspecies of elk has been extirpated. Skovlin (1982:370) contends that of these foraging strategies, browsing was of secondary importance and grazing was a more efficient means of forage consumption. Murie (1951:313) reported crop damage to corn fields by modern elk herds. Due to their opportunistic ways, it is possible that elk also invaded Great Oasis corn fields. Due to the overall adaptability of elk, if given adequate protection and habitat, elk could recolonize the Great Plains (Skovlin 1982:370). With these factors in mind, elk were probably less numerous in the study area than white-tailed and had less capacity to rebound from population stress.

#### Bear

The black bear (*Ursus americanus*) may have had some economic value to the Great Oasis people in the form of meat, hide, and fat. There is no archaeological evidence of the black bear being a resource to the Great Oasis people but there are ample ethnographic references (Styles 1981:86)

that suggest when bears were available, they were hunted. They may have been hunted for ritualistic purposes as was done by some historic Native American groups (Ritzenthaler and Ritzenthaler 1983:23). When compared to other large mammals of the study area, black bears have a much lower population density. Black bears would therefore probably require more effort to hunt and maintained an element of risk to the hunter (Schwartz and Schwartz 1981:278-282).

## CHAPTER 6. SITE DESCRIPTIONS

## Noah's Bottom Locality (Boone County Sites)

The following sites are listed in order of their designation following the Smithsonian Trinomial system. This includes those sites that were reviewed but rejected as confirmed Great Oasis sites due to the lack of diagnostic ceramics. The ratings (1 through 5) were assigned to each site based on the "Great Oasis Index Test" as described in Chapter 3. Common names of sites are given when available (Figures 1 and 2).

13BN27: Boone County, Boone W Quadrangle, Township 84N, Range 27W, Section 36.

This site is situated on an intermediate/high terrace complex (Bettis and Hoyer 1986:39) on the east side of the Des Moines River directly north of Old Highway 30. In the higher and westerly portions of this site an alluvial fan emanates from a late Wisconsinan bench. An unnamed intermittent stream borders the site to the northwest and another unnamed intermittent stream to the south. Great Oasis artifacts curated at ISUAL were recovered from surface surveys. Among the diagnostic artifacts are included three Great Oasis Wedge Lip rim sherds and a large thick plain Great Oasis High Rim rim sherd. Based on artifact analysis, this site has been rated at 4 and has a confirmed Great Oasis component.

Hubby 13BN38: Boone County, Madrid NW Quadrangle, Township 82N, Range 26W, Section 5.

This site is located on an intermediate/high terrace (Bettis and Hoyer 1986: 48) abutting a Wisconsinan-aged terrace on a sweeping bend of

the Des Moines River. Diagnostic artifacts recovered from surface surveys include Great Oasis High Rim incised rim sherds and an incised wedge lip-type that appears to be an intermediate example between Great Oasis High Rim and Great Oasis Wedge Lip. Based on these artifacts, this site has been rated 4. This site is considered to be in the Noah's Bottom locality and is its most southerly member.

13BN40: Boone County, Boone W Quadrangle, Township 84N, Range 26W, Section 31.

13BN40 is situated on a colluvial slope fan above an intermediate terrace (Bettis and Hoyer 1986:39) adjacent to the Des Moines River. The review of artifacts was problematic in determining a Great Oasis component at this site. A review of the physical artifacts curated at ISUAL reveal thin gray and tan globular body sherds were recovered from surface surveys. No diagnostic Great Oasis artifacts were in this collection. Osborn and Gradwohl (1982:145,146) made specific references to a Great Oasis High Rim rim sherd at this site with accompanying diagrams. The site inventory sheet at ISUAL also made reference to the artifact. The actual whereabouts of this rim sherd remains unknown. Based on the documented evidence rather than the review of the complete physical collection this site is provisionally rated at 4. This site lies within 1.5 kilometers of three confirmed Great Oasis sites in the vicinity but is situated uncharacteristically high on a colluvial fan rather than a high terrace.

Logansport 13BN103: Boone County, Boone W Quadrangle, Township 84N, Range 27W, Section 24.

The Logansport Site is situated on a high terrace overlooking the Des Moines River (Bettis and Hoyer 1986: Figure 15). This site is positioned

with Sand Creek entering the Des Moines River to the northwest. A fan/high terrace complex is to the eastern margin of the site. Controlled excavations have been conducted at Logansport as part of Iowa State University's Anthropology program in the 1970s, 1980s and 1990s. Numerous diagnostic Great Oasis ceramics have been recovered from this site including Great Oasis Incised rim sherds (Gradwohl 1991). Despite the extensive excavations at this site, no house features attributed to Great Oasis were located. Based on diagnostic ceramics, this site is rated 4.

Meehan-Schell 13BN110: Boone County, Boone W Quadrangle, Township 83N, Range 27W, Section 2.

The Meehan-Schell Site is situated on a high terrace (Bettis and Hoyer 1986:39) between Coal Valley Creek to the South and Noah Creek to the North which enter the Des Moines River approximately 0.8 kilometers from the site. Due to the relocation of Boone County Road R18 and the imminent destruction of the site, a controlled excavation of this site was conducted by Gradwohl of Iowa State University in 1968 and 1970 (Mead 1981:18). Cache pits and post molds were mapped features and Mead conducted a descriptive analysis of seed remains from 13BN110. Diagnostic Great Oasis artifacts currently curated at ISUAL include Great Oasis High Rim Incised and Plain rim sherds. This site is rated as 5 due to diagnostic artifacts found in situ.

Noah Creek Kiln 13BN111: Boone County, Boone W Quadrangle, Township 83N, Range 27W, Section 2.

Noah Creek Kiln lies on a high terrace (Bettis and Hoyer 1986:39) adjacent to Coal Valley Creek which enters the Des Moines River approximately 0.7 kilometers to the east. This site was also excavated by



ISUAL due to the relocation of Bone County Road R18. The Great Oasis component was under a rather extensive historic farmstead and kiln. A single Great Oasis High Rim Incised rim fragment (13BN111-1354) was recovered and cataloged. This site has been rated 4 on the basis this rim sherds. In addition, several thin globular smooth body sherds were recovered which strongly resemble Great Oasis ceramics.

13BN113: Boone County, Boone W Quadrangle, Township 84N, Range 27W, Section 36.

This site is situated on an intermediate terrace (Bettis and Hoyer 1986:39) along the Des Moines River. Surface surveys by ISUAL have yielded diagnostic artifacts in the form of Great Oasis High Rim Incised and Plain rim sherds. 13BN114 is directly to the southeast of 13BN113. These sites may actually be only a single site. 13BN113 has been rated as 4 due to diagnostic artifacts. McNerney and Titus (1997) revised this site in 1996 but did not identify a Great Oasis component at this location.

13BN114: Boone County, Boone W Quadrangle, Township 84N, Range 27W, Section 36.

13BN114 lies on an intermediate/high terrace (Bettis and Hoyer 1986:39) along the Des Moines River and is adjacent to 13BN113. Surface surveys have yielded probable Great Oasis ceramics in the form of plain high rim with a modified lip and characteristic Great Oasis tool impressions. This site has been rated as 3.

Sparks Site 13BN121: Boone County, Boone W Quadrangle, Township 83N, Range 27W, Section 1.

Sparks Site (13BN121) lies on an intermediate terrace (Bettis and Hoyer 1986:39) between Noah and Coal Valley Creeks overlooking the Des

Moines River. 13BN110 (Meehan-Schell) is directly west of Sparks. Several diagnostic examples of Great Oasis ceramics were recovered from the Sparks site through surface surveys. These include Great Oasis High Rim Incised rim sherds and a Great Oasis Wedge Lip rim sherd. This site has been rated as 4.

For the purposes of this study, Sparks site (13BN121) has been selected as a hypothetical "focal point" for the Noah's Bottom locality. This designation was selected due to the combination of the following factors: (a) 13BN121 has a commanding view of the Des Moines River and is between two year-round flowing streams, (b) 13BN121 has the greatest amount of potentially tillable land within 1 kilometer of the site than any other Boone County Site, and (c) 13BN121 appears to be centrally located relative to all other confirmed Great Oasis sites in Boone County.

13BN127: Boone County, Boone W Quadrangle, Township 83N, Range 27W, Section 1.

This site is located on the same high terrace complex as Meehan-Schell (13BN110) and Noah Creek Kiln (13BN111) and is approximately 0.3 kilometers directly north of Sparks site (13BN121). Due to the proximity to other confirmed Great Oasis sites there is a high probability that 13BN127 is a Great Oasis Site. The surface-gathered artifacts do not bear this out. Thin gray globular body sherds were recovered but no conclusive Great Oasis ceramics were found. Further sub-surface investigations may be needed to substantiate this hypothesis. This site has been rated 2 and is not used for statistical analysis. McNerny and Titus (1997:54,76) have tentatively speculated on a Great Oasis component at 13BN127 but this has yet to be verified.



Old Moser 13BN130: Boone County, Boone W Quadrangle, Township 84N, Range 27W, Section 23.

This site is situated on an intermediate/high terrace (Bettis and Hoyer 1986:39) directly east of the Des Moines River. Controlled excavations were conducted at this site by ISUAL in the summer of 1969 (Broihahn 1997:39). Artifacts recovered revealed significant Great Oasis diagnostic ceramics including Great Oasis High Rim Incised and Wedge Lip. This site has been rated 5.

13BN148: Boone County, Granger Quadrangle, Township 82N, Range 26W, Section 34.

13BN148 is located on a Late Wisconsinan terrace (Bettis and Hoyer 1986: Fig. 15). This site was brought to the attention of the researcher through a computer-aided search of site records at the Office of the State Archaeologist. The description of thin globular body sherds give the impression of Late Woodland rather than Great Oasis. A single thin cord-impressed rim sherd was recovered which appears to be Late Woodland Saylorware. Due to its distance from the nearest confirmed Great Oasis site (approximately 8.2 linear kilometers and 11.1 kilometers via travel route), this site has been rated as 1 and has not been included in statistical analysis.

13BN170: Boone County, Boone W Quadrangle, Township 84N, Range 26W, Section 31.

This site lies on uplands up-slope from a high terrace/fan (Bettis and Hoyer 1986:39). As was the case with 13BN148, 13BN170 was brought to the attention of the researcher through a computer-aided search at the Office of the State Archaeologist. It receives a rating of 2 due to the

lack of diagnostic artifacts. Artifact review reveals only a single thin tan globular body sherd. Except for mortuary sites, upland locations for Great Oasis sites is uncharacteristic in the Boone, Dallas, and Polk County study area.

13BN203: Boone County, Madrid NW Quadrangle, Township 82N, Range 26W, Section 5.

13BN203 lies on an intermediate terrace with an alluvial fan on the northeast 25% of the site (Bettis and Hoyer 1986:48) directly adjacent to the Des Moines River to the east. This site is on the opposite bank of the river and approximately 1 kilometer upstream from 13BN38. A diagnostic Great Oasis High Rim Incised was recovered from this site. This site was rated 4.

#### Lower South Raccoon River Locality (Dallas County Sites)

Paardekooper 13DA11: Dallas County, Redfield Quadrangle, Township 78 N, Range 29W, Section 9.

Paardekooper is a multi-component burial site located on the high point of a late Wisconsinan-age upland overlooking the confluence of the Middle and South Raccoon Rivers. This site was inadvertently exposed in 1977 by Iowa Department of Transportation work crews during construction efforts for a new bridge for Highway 6. Fokken (1981) reported a minimum of eight individuals in one mass burial. Finney (1994:63) reports "one thin, plain-surfaced Great Oasis body sherd" recovered at this site. This artifact was reviewed by the author and did not show enough diagnostic characteristic attributes to conclusively validate it as Great Oasis origin. Therefore, this site was rated at 2 and not used for statistical analysis. It must be stressed however, that Paardekooper is directly

adjacent to the DeCamp burial site (13DA64) (See 13DA64) which unquestionably has a Great Oasis component. It is quite possible that Paardekooper and DeCamp are in fact a single site bisected by the current Highway 6.

Landis 13DA12: Dallas County, Waukee Quadrangle, Township 78N, Range 27W, Section 20.

The Landis site is situated on an intermediate terrace at the confluence of the North and South Raccoon Rivers directly south of the current Interstate Route 80. Controlled sub-surface testing was completed by Hotopp and Till in 1977 and 1978 in Phase I and II testing. These excavations located intact pit features and Great Oasis cultural material including Great Oasis High Rim Incised and Plain rim sherds and a plain rim sherd that appears to be an intermediate between High Rim and Wedge Lip. These artifacts are now curated at the Office of the State Archaeologist (OSA). On this basis, 13DA12 has been rated 5.

Two Cottonwoods 13DA25: Dallas County, Waukee Quadrangle, Township 78N, Range 27W, Section 20.

The Two Cottonwoods is located approximately 0.25 kilometers to the northwest of Landis (13DA12) at a slightly higher elevation (high terrace) than the latter on the same terrace complex. Landis and Two Cottonwoods may be a single site. Hotopp and Till (Finney et al. 1994:66) identified a single Great Oasis incised rim sherd but the referenced artifact could not be located during artifact review by the author. On this basis, 13DA25 was rated 2 and not included in statistical analysis.

13DA33: Dallas County, Adel Quadrangle, Township 78N, Range 27W, Section 14.

13DA33 is situated on an intermediate/high terrace south and east of a bend in the South Raccoon River. It is directly adjacent to a meander scar of that river (Finney et al. 1994:68). Due to its geographic location and on the basis of smooth and smoothed over cord marked ceramic body sherds found at the site, Finney identified a probable Great Oasis component at this site (Finney et al. 1994:68). For the purposes of this study, this is not conclusive evidence of a great Oasis component. 13DA33 is rated as 2 and not used for statistical analysis. 13DA33 should be given a high priority for additional surface and subsurface surveys to determine the existence of a Great Oasis component.

13DA37: Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Section 9.

13DA37 is located on a high terrace overlooking the South Raccoon River and within easy visible view of the confluence of the South and Middle Raccoon Rivers. A single Great Oasis High Rim Incised rim sherd was recovered from this site and is currently curated at OSA (Accession #1603-13DA37-3). On this basis, the site is rated 4. 13DA37 was selected as a hypothetical "focal point" of the Lower Raccoon River locality due to its commanding view of the confluence of the Middle and South Raccoon Rivers, its central location to other sites with a confirmed Great Oasis components, its relatively large amount of potentially tillable low terrace ground, and its proximity to the Great Oasis burials at DeCamp (13DA64) and probably at Paardekooper (13DA11). The Maxwell site (13DA264) partially

fits this criteria but was not selected due to its positioning relative to the confluence of the Middle and South Raccoon Rivers.

13DA40: Dallas County, Waukee Quadrangle, Township 78N, Range 27W, Section 16.

13DA40 is located on an alluvial fan (Finney et al. 1994:70) approximately 0.3 kilometers from the North Raccoon and about 1.3 kilometers upstream from the confluence of the North and South Raccoon Rivers. Finney has attributed a Great Oasis occupation to this site based on thin plain-surfaced bodysherds (1994:70). Upon review of these artifacts by the author, the sherds in question may be Great Oasis but cannot be proven so. Therefore 13DA40 was rated 2 and not used for statistical analysis. As is the case of 13DA33, 13DA40 could be confirmed to have a Great Oasis component if additional surface and sub-surface testing were applied.

13DA53: Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Section 4.

With the exception of burial sites, 13DA53 is uncharacteristically located on a Wisconsin-aged upland overlooking the Middle Raccoon River directly to the west and approximately 0.75 linear kilometers from the confluence of the South Raccoon and Middle Raccoon Rivers to the south. 13DA64 and 13DA11 are positioned approximately 0.4 kilometers to the south-southeast at a slightly lower elevation. Surface collection yielded two Great Oasis High Rim Incised rim sherds. This site has not been thoroughly investigated but is rated a 4 on the basis of diagnostic artifacts.

DeCamp 13DA64: Dallas County, Redfield Quadrangle, Township  
78N, Range 29W, Sections 4 and 9.

The DeCamp site has a confirmed Great Oasis burial component. This rather impressive multi-component site is located on the uplands overlooking the confluence of the Middle and South Raccoon Rivers and directly adjacent to Paardekooper (13DA11) (See 13DA11). This site was investigated by Musgrove in 1964-1965 and approximately 84 individuals were excavated. Controlled excavations were completed by Musgrove (Finney et al. 1994:62-63), however, the precision of the excavation and documentation is not up to current archaeological standards. Among the diagnostic artifacts recovered were two small, complete pots: a Great Oasis High Rim Incised and a Great Oasis Wedge Lip. In addition, 425 *Leptoxis* shell beads and a polished basalt celt were recovered. On the basis of these artifacts, DeCamp is rated 5 and included in statistical analysis. It must be noted however that this site does not appear to be a habitation zone and should be given special consideration.

Harmon College 13DA107: Dallas County, Adel Quadrangle, Township  
78N, Range 28W, Sections 7, 8, and 17.

13DA107 is located on an intermediate/high terrace directly west of the South Raccoon River. This site was initially surveyed by Gradwohl and Sloan in 1966 and later by OSA staff in 1993 (Finney et al. 1994:85). There was no sub-surface testing completed at this site. Diagnostic artifacts include one Great Oasis High Rim Incised rim sherd. In addition, polished celts were recovered at this site. Based on this evidence, 13DA107 is rated at 4.

Kuehn 13DA110: Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Sections 12 (Union Township), 7 (Adams Township).

The Kuehn site (also known the Crab Village site) is situated on an intermediate/high terrace along the South Raccoon River. This site was surface-surveyed by Anderson, Sloan, and Gradwohl in 1966 and recorded at that time. Finney and Mandel conducted back-hoe trench sub-surface testing in 1993 and recorded Feature 1, a cache pit with a Great Oasis component (Finney et al. 1994). In 1995 the Iowa State University Anthropology Department conducted its archaeological field school at Kuehn. Great Oasis High Rim Incised rim sherds were recovered on each investigation including a rim sherd in situ from Feature 1 by Finney and Mandel. This site is therefore rated 5.

Some discussion of Iowa State University's field school is in order. In Test Excavation Unit #17 Feature 8 gives rise to the probable (although not conclusive) location of a Great Oasis pit house. Unit #17 was 1 meter x 2 meters and approximately 1 meter deep with roughly an east-west orientation. At approximately 50 cm below mean surface elevation, a series of horizontal charred logs were exposed. The original diameter of these logs was estimated to be 15-20 cm. The length of these logs could not be determined due to the limited surface area of the test unit. At approximately 80 cm below mean surface elevation, a hearth lens and post molds were identified and thin, smooth, globular body sherds were located on the apparent living surface less than a meter from the hearth feature. The position of the post molds in relation to the hearth (approximately one meter) is suggestive of a Great Oasis pit house. The current hypothesis by Tiffany and the author is Feature #8 represents a probable Great Oasis pit



house destroyed by fire. The sand-tempered body sherds located within Feature #8 appear to be Great Oasis but this is not conclusive evidence. To test this hypothesis, Excavation Test Unit #17 could be re-opened and expanded to determine the dimensions of the dwelling and to recover more diagnostic Great Oasis artifacts.

Applegate 13DA111: Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Sections 1 and 12.

The Applegate is located on a high terrace overlooking the South Raccoon River to the east. This site was surface-surveyed by Anderson, Sloan, and Gradwohl in 1966 and sub-surface tested with backhoe trenching by OSA in 1994 (Finney et al. 1994:86). Applegate was listed on a computer-aided search, however, no diagnostic Great Oasis artifacts were recovered. This site has been rated 2 on the basis of its proximity to other nearby sites with a confirmed Great Oasis component. Applegate has not been used for statistical analysis.

Windmill Village 13DA112: Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Section 2.

The Windmill Village site is situated on intermediate-high terrace on a bend of the South Raccoon River with the site lying south and east of the river. Surface collections by Anderson, Sloan and Gradwohl in 1966 yielded celt fragments but no diagnostic Great Oasis artifacts. The site was revisited in 1993 by OSA (Finney et al. 1994:86) and two diagnostic Great Oasis High Rim Incised rim sherds were recovered. On the basis of these artifacts, 13DA112 has been rated 4.

The Keufner site (13DA126) (having a confirmed Great Oasis component) is located directly east of 13DA112. These sites are separated by an



historic road. It is likely that these two are in reality a single site on the same river bend and terrace. For that reason, the statistical analysis for 13DA112 does not include 13DA126, but assumes they are the same site.

Smith's Hilltop 13DA117: Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Section 9.

Smith's Hilltop site is situated in the uplands upslope from 13DA37 overlooking the confluence of the Middle and South Raccoon Rivers (Finney et al. 1994:75). This site was identified in 1966. No diagnostic Great Oasis artifacts were recovered and therefore is rated 1 and not used for analysis. This site could be a burial location as it is reminiscent of the DeCamp, Paardekooper, and West Des Moines burials.

Keufner 13DA126: Dallas County, Redfield Quadrangle, Township 78N, Range 28W, Section 2.

The Keufner site is located on the same river bend and terrace complex as the Windmill Village site (13DA112) (See 13DA112). Surface surveys in 1993 recovered a single Great Oasis High Rim Incised rim sherd (Finney et al. 1994:88). This site has been rated 4.

13DA256: Dallas County, Adel Quadrangle, Township 78N, Range 28W, Section 18.

13DA256 is located on hilltop overlooking the Harmon College site (13DA107) and the South Raccoon River to the east. This would be an uncharacteristic habitation location for Great Oasis Culture people. Artifact review showed a single thin, tan, smooth, globular body sherd from this site. Finney suggests a Great Oasis component based on this body sherd (Finney et al. 1994:88). For the purposes of this study, this is not sufficient evidence to verify a Great Oasis component. On this basis,

13DA256 is rated 2 and not included in statistical analysis. Additional subsurface testing may reveal a Great Oasis component in the form of a burial as it is located on the uplands above a confirmed Great Oasis site.

13DA264: (Maxwell) Dallas County, Redfield Quadrangle, Township 78N, Range 29W, Section 9.

The Maxwell site is located on a Gunder (high) terrace (Mandel 1996:5) directly adjacent to the South Raccoon River to the east and approximately 0.6 kilometers from the confluence of the South and Middle Raccoon Rivers. This site is the most extensively excavated Great Oasis habitation zone in Dallas County. Features including storage and refuse pits and a probable Great Oasis pit house were excavated by OSA in 1994 (Doershuk and Finney 1996). Diagnostic artifacts recovered in situ include Great Oasis High Rim Incised and Plain rim sherds. On the basis of these artifacts, this site is rated 5. A large volume of soil samples were recovered and archaeobotanical samples were analyzed (Asch 1996:29-37).

#### Walnut Creek Locality (Polk County Site)

13PK38: (West Des Moines Burial) Polk County, Des Moines SW Quadrangle, Township 78N, Range 25W, Section 10.

13PK38 is a large Great Oasis cemetery situated in the uplands on the top of the Bemis Moraine (Ruhe 1969: 60-66) on a margin of the valley wall overlooking the confluence of Walnut Creek and the Raccoon River. The West Des Moines Burial is the only confirmed Polk County Great Oasis site.

Special note will be made of this significant site.

Not all Midwest archaeology has been completed under strict spatial or temporal controls. More often than not human burials are discovered accidentally as the result of earth moving by power equipment or by natural

causes. Iowa currently has a very strict burial and re-burial code implemented in 1974. In the light of cultural sensitivity, activities such as "mound probing" are discouraged by the discipline of anthropology. Such was not the case in July of 1963 in West Des Moines, Iowa.

At the hilltop corner of Ashworth Road and Ninth Street in West Des Moines, the Joe A. Swift Construction Company began work to excavate the foundation of the Crestview Acres Retirement Home. During the initial excavation, work crew members noticed what appeared to be a number of human bones in the excavated material and protruding from the wall of the excavation cut. The remains were reported to the Polk County Medical Examiner on 18 July 1963 and officials from the State Department of History and Archives arrived at the site on Monday, 22 July 1963 (Zelenka 1963). During the next week remains from as many as 18 individuals were recovered along with *Leptoxis* shell beads and a number of carved shell crosses, lithics, and ceramics (Knauth 1963b:81-91, Musgrove 1963a, b). The shell crosses were erroneously attributed to Christian influence.

In reviewing the series of daily status reports of the excavation in the *Des Moines Register* between 22 July 1963 and 30 July 1963 one is left with the impression of a professional archaeological excavation and unqualified support from the Joe A. Swift Construction Company (Knauth 1963a, b, c). In retrospect, it appears neither was the case. By today's standards such excavations would be completed with more experienced personnel with much more excavation time allotted. Otto Knauth assisted in the excavation and wrote descriptive articles of his experiences. Following communication with him (20 November 1995), Knauth characterized the excavation as "confused" and that the contractor, Joe A. Swift "acted

reluctantly." The initial overburden from the building excavation was trucked and dumped as land fill in a low spot on the nearby grounds of Stillwell Junior High School. Local artifact hunters picked through the fill and recovered artifacts and some human remains (Pederson 1963). According to the text of Jack Musgrove's unpublished draft of the final site field report, an observer to the construction operation named Brady counted 17 human skulls as they were trucked away as land fill (Musgrove 1963c:5). This leads to the speculation that officials of the construction company may have deliberately ignored the fact that they were disturbing human graves. The 1995 administration of Stillwell Junior High School was unaware of the history of the West Des Moines Burial Site or of the strong probability that human remains are currently buried on the school grounds (Woodard personal communication 21 November 1995). The human remains recovered are now housed at the Office of the State Archaeologist in Iowa City, Iowa (Schermer personal communication 9 October 1995).

At least one burial at 13PK38 was located and not excavated due to its being bound by tree roots (Knauth 1963d:87). The suspected borders of the site were trenched and the surface was skimmed with power equipment and no additional artifacts were found (Knauth 1963d:89). Considering the brevity of the excavation and the lack of archaeological skill by the excavators, it would stand to reason that this final reconnaissance without artifacts may not have been accurate. This lack of artifacts found does not necessarily indicate the entire site was excavated, or even located. Knauth contends there may still be unlocated burials at the site (personal communication 20 November 1995). In June of 1999, the author spoke with the current administrator of Crestview Acres and gave a brief history of the

excavations. There are several large ash trees on the property that predate 1963. This may be an indication that the entire site was not excavated. The habitation zones in conjunction with the West Des Moines burial have not been located.

## CHAPTER 7. SOIL DESCRIPTIONS

The following descriptions of soil units associated with Great Oasis sites uses the Boone County Soil Survey (Andrews and Dideriksen 1981:5-137) and the Dallas County Soil Survey (Dideriksen 1983:1-165). Along with background information on each soil, pH and modern yield estimates for corn are given to give some idea of general soil productivity. This section describes primarily those alluvial soil types on the river and side valley terrace complexes within the 1-kilometer site catchment. As needed, upland soils will be described if they fall within the site catchment (Tables 1 through 4).

Noah's Bottom Locality (Boone County) - Soils at  
or Adjacent to Great Oasis Sites

Buckney fine sandy loam (636). Buckney fine sandy loam is derived from mixed sandy calcareous alluvium on raised areas of bottom lands and has a slope of 1-3%. The pH of this soil unit in the upper level (0-17 inches) is 6.6-7.8 which is mildly acidic to mildly basic. Corn yield estimates using modern agricultural methods is 74 bushels to the acre. The mapped sites with Great Oasis components in the Bone County study area with Buckney fine sandy loam are 13BN27, Hubby (13BN38) and Logansport (13BN103). 13BN27 has Buckney fine sandy loam on TH. This soil unit is located on or adjacent to TI at 13BN27, Hubby, Logansport, Old Moser (13BN130), and 13BN203. Buckney fine sandy loam is associated with 56% of sites in the Boone County Study area.

Table 1. Noah's Bottom (Boone County) Great Oasis Sites soil descriptions (same side of river)

Site	Soils at Site	Soils at TH	Soils at TI	Soils at TL
13BN27	636, 733, 566B	566B,C	636, 733, 566B	1636
13BN38	536, 636	73D,F, 778B,C	135, 536, 636	1636
13BN103	636, 566B,D 485	636, 566B,D 485	566B, 485, 636	1636
13BN110	566B, 135	566B	135	1636
13BN111	444C, 566B	444C, 566B	135, 2485B	1636
13BN113	28B	28B	28B,C, 135	1636
13BN114	135, 28B	28B	28B,C, 135	1636
13BN121	135	566B	135	1636
13BN130	485	485, 224, 566B 28B, 778B,C	636, 135, 733 536, 2485B	1636
13BN203	536, 566C	(no TH)	636, 536, 566C	1636

Key:

28B,C	Dickman fine sandy loam, 1-5%, 5-9% slopes
73D	Salida gravelly sandy loam, 5-14% slope
135	Coland clay loam, 0-2% slopes
224	Linder sandy loam, 0-2% slopes
444C	Jacwin loam, 3-9% slopes
485	Spillville loam, 0-2% slopes
536	Hanlon fine sandy loam, 0-2% slopes
566B,D,C	Moingona loam, 1-5%, 5-9%, 9-14% slopes
636	Buckney fine sandy loam, 1-3% slopes
733	Calco silty clay loam, 0-2% slopes
778B,C	Sattre loam, 0-2%, 2-5% slopes
1636	Buckney fine sandy loam, channeled, 0-2% slopes
2485B	Spillville-Buckney complex, 2-5% slopes



Table 2. Noah's Bottom (Boone County) Great Oasis Sites (soils by location and landform on same side of river)

	On Site	TH	TI	TL
Buckney fine sandy loam, 1-3% slopes. 636	27%	9%	--	--
Buckney fine sandy loam, channeled, 0-2% slopes. 1636	--	--	--	100%
Calco silty clay loam, 0-2% slopes. 733	9%	--	27%	--
Coland clay loam, 0-2% slopes. 135	27%	--	73%	--
Dickman fine sandy loam, 1-5%, 5-9% slopes. 28 B,C	18%	27%	27%	--
Hanlon fine sandy loam, 0-2% slopes. 536	18%	--	27%	--
Jacwin loam, 3-9% slopes. 444C	9%	9%	--	--
Linder sandy loam, 0-2% slopes. 224	--	9%	--	--
Moingona loam, 1-5%, 5-9%, 9-14% slopes. 566 B,C,D	55%	55%	--	--
Salida gravelly sandy loam, 5-14%, 14-25% slopes. 73 D,F	9%	9%	--	--
Sattre loam, 0-2%, 2-5% slopes. 778 B,C	--	27%	--	--
Spillville-Buckney complex, 2-5% slopes. 2485 B	--	--	9%	--
Spillville loam, 0-2% slopes. 484	18%	18%	9%	--



Table 3. Lower South Raccoon River and Walnut Creek localities (Dallas and Polk County) Great Oasis Sites soil descriptions (same side of river)

Site	Soils at Site	Soils at TH	Soils at TI	Soils at TL
13DA12	7	27B	7	200, 1,220
13DA37	76C2	76C2, 27C	220	1,314
13DA53	169B*	829D2, 17B, 169B*	220	1,314
13DA64	829D2**	829D2**, 27B	220	1,314
13DA107	27C, 220	27C	220	220
13DA110	220, 27C	27C	220	220
13DA112	7	(no TH)	7,220	1,314
13DA126	7	(no TH)	7,220	1,314
13DA264	7,220	88, 823C, 308, 308B, 203	7,220	1,314
13PK38	4138B			

\* 13DA53 is located on a Wisconsin-aged upland.

\*\* 13DA64 is located on a Wisconsin-aged upland.

Key:

7	Wiota silt loam, 1-3% slopes
27B,C	Terril loam, 2-5%, 5-9% slopes
76C2	Ladoga silty clay loam, 5-9% slopes
88	Nevin silty clay loam, 0-2% slopes
169B	Clarion loam, 2-5% slopes
203	Cylinder loam, 32 to 40 inches to sand and gravel, 0-2% slopes
220	Nodaway silt loam, 0-2% slopes
308,B	Wadena loam, 32 to 40 inches to sand and gravel, 0-2%, 2-5% slopes
823C	Ridgeport sandy loam, 5-9% slopes
829D2	Zenor-Storden complex, 9-14% slopes
1220	Nodaway silt loam, channeled, 0-2% slopes
1314	Hanlon-Spillville complex, channeled, 0-2% slopes
4138B	Clarion-Urban land complex, 2-5% slopes

Table 4. Lower South Raccoon River locality (Dallas County) Great Oasis Sites (soils by location and landform on same side of river)

	On Site	TH	TI	TL
Clarion loam, 2-5% slopes. 169B	11%	11%	--	--
Cylinder loam, 32 to 40 inches to sand and gravel, 0-2% slopes. 203	--	11%	--	--
Hanlon-Spillville complex, channeled 0-2% slopes. 1314	--	--	--	67%
Ladoga silty clay loam, 5-9% slopes. 76C2	11%	11%	--	--
Nevin silty clay loam, 0-2% slopes. 88	--	11%	--	--
Nodaway silt loam, 0-2% slopes. 220	22%	--	89%	33%
Nodaway silt loam, channeled, 0-2% slopes. 1220	--	--	--	11%
Ridgeport sandy loam, 5-9% slopes. 823C	--	11%	--	--
Terril loam, 2-5%, 5-9% slopes. 27B,C	11%	67%	--	--
Wadena loam, 32 to 40 inches to sand and gravel, 0-2%, 2-5% slopes. 308B	--	11%	--	--
Wiota silt loam, 1-3% slopes. 7	44%	--	44%	--
Zenor-Storden complex, 9-14% slopes. 829D2	11%	11%	--	--

Buckney fine sandy loam, channeled (1636). Buckney fine sandy loam, channeled is fine-grained alluvium on the lowest reaches TL of the modern floodplain with a 0-2% slope. This soil strongly resembles the Camp Creek member of the DeForest Formation (Bettis 1995:17). According to Bettis (Bettis and Hoyer 1986:32) this terrace developed after 750 years BP. This soil unit does not occur on any Great Oasis component sites in the study area and is adjacent to all referenced sites along the banks of the modern

Des Moines River channel. It is questionable if this soil type is related to the Great Oasis sites of this study. The pH of Buckney fine sandy loam, channeled at the upper level (0-17 inches) is 6.6-7.3 which is mildly acidic to mildly basic. Corn yield estimates using current agricultural practices are not estimated due to its location on active floodplains.

Calco silty clay loam (733). Calco silty clay loam is bottom land alluvial soil derived from glacial till and has a slope of 0-2%. The pH of this soil unit at its upper level (0-35 inches) is 7.4-8.4 which is mildly basic to moderately basic. The estimated yield for corn using modern agricultural practices is 95 bushels per acre. In the Boone County study area, only 13BN27 has Calco silty clay loam on the mapped site. There are no Great Oasis component sites in the Boone County study area with Calco silty clay loam on TH. This soil unit is found on TI on or adjacent to 13BN27 and Old Moser (13BN130).

Coland clay loam (135), 0-2% slopes. This soil is nearly level (0-2% slopes) and found exclusively in the TI of the sites in the study area. It is derived from alluvium. The pH of the upper level (0-41 inches) is 6.1-7.3 which is mildly acidic to neutral. Corn yield estimates using modern agricultural techniques are approximately 102 bushels per acre. Coland clay loam appears to be significant in the Noah's Bottom Locality. Of the nine referenced sites, three were located on Coland clay loam (33%) and seven (78%) had this soil type directly adjacent to it. In addition, 13BN203 (which does not have a 135 unit) is located in a zone of modern river meandering. There may have been a unit of Coland clay loam at the site 1,000 years BP which has been subsequently eroded away.

Dickman fine sandy loam (28B, C). This gently to moderately sloping soil (1-5% and 5-9%, respectively) is located on convex upland side slopes of major streams. It is formed on eolian sand. The upper level (0-16 inches) pH 6.1 to 6.5, which is mildly acidic. Yield estimates for corn using modern cropping techniques is from 45 to 50 bushels per acre. This soil type is found on TH and TI of 13BN113, 13BN114, and Old Moser (13BN130).

Hanlon fine sandy loam (536), 0-2%. Hanlon fine sandy loam is nearly level soil (0-2% slopes) derived from bottom land alluvium and natural levees. The pH in the upper level is 6.6-7.3 which ranges from mildly acidic to mildly basic. Corn yield estimates using modern agricultural practices is approximately 92 bushels per acre. Hanlon fine sandy loam is not found on TH in the Boone County study area. Hubby (13BN38) and 13BN203 have this soil unit at the site on TI. This soil unit is also on the TI adjacent to Old Moser (13BN130).

Linder sandy loam (224). Linder sandy clay loam is an alluvial soil with a 0-2% slope formed on stream terraces underlain with sand and gravel. The pH of the upper level (0-19 inches) is 5.6-7.8 which is moderately acidic to mildly basic. Corn yield estimates using modern agricultural techniques is about 55 bushels per acre. This soil type is found on TH of Old Moser (13BN130).

Jacwin loam (444C). 3-9% slopes. Jacwin loam is moderately sloping (3-9%) alluvial soil found on depressions of terraces. The pH of the upper level (0-13 inches) is 6.6 to 7.3 which is mildly acidic to mildly basic. Corn yield estimates using modern agricultural techniques is about 70

bushels per acre. The Noah Creek Kiln site (13BN111) is located on TH which contains that soil unit.

Moingona loam (566B, C, D). Moingona loam is derived from alluvium on foot slopes and along major streams. The slopes of these soil units are 1-5%, 5-9% and 9-14%, respectively. The pH of this soil unit in the upper level (0-12 inches) is 5.6-7.3 which is moderately acidic to mildly basic. Estimates for corn yield using modern agricultural methods is 100-113 bushels per acre. Moingona loam is significant to this study. In the Boone study area, Moingona loam is found on TH and TI. This soil unit is found on site at 13BN27, Logansport (13BN103), Noah Creek Kiln (13BN111), and 13BN203 which is 44% of the Great Oasis component sites. Moingona loam is found on TH on or adjacent to 13BN27, Logansport, Meehan-Schell (13BN110), Noah Creek Kiln, Sparks (13BN121), and Old Moser (13BN130). This soil unit is located on TI on or adjacent to Logansport, 13BN27, and 13BN203. Seven of the nine Boone County Great Oasis sites are associated with Moingona loam yielding 78%.

Salida gravelly sandy loam (73D, F). This moderately to very steeply sloping soil (5-14% and 14-25%, respectively) is located on uplands and high terraces formed on glacial outwash and alluvium. The upper level pH (0-8 inches) is 6.1-8.4. This ranges from mildly acidic through neutral to mildly basic. As this is generally fairly steep land and prone to drying out, modern corn yield estimates are not given. This soil type can be found directly upslope from the TH at Hubby (13BN38). Although factored into the statistical analysis for soils in the study, there is very little likelihood of its use for cultivation by Great Oasis people and its effect on the analysis of potentially tillable land is negligible.

Sattre loam (778B, C). Sattre loam (13BN40) is gently to moderately sloping soil (2-5% and 5-9%, respectively) on stream benches. This soil unit is alluvium underlain by sand and gravel. The pH of this soil at the upper level (0-15 inches) is 6.1 to 6.5 which is mildly acidic. Corn yield estimates using modern agricultural techniques is approximately 86 bushels per acre. Sattre loam is not directly on any site with Great Oasis components nor is it located on TI at the Boone County referenced sites. Sattre loam is on TH adjacent to Hubby (13BN38) and Old Moser (13BN130).

Spillville loam (485). Spillville loam is an alluvial soil on bottom lands. This soil is level to gently sloping at 0-2%. The pH of the upper level (0-52 inches) is 5.6-7.3 which is moderately acidic to mildly basic. The modern agricultural corn yield estimate is 122 bushels per acre. Old Moser (13BN130) and Logansport (13BN103) are located on this soil unit on TH. This soil unit also occupies TI of Logansport.

Spillville-Buckney complex (2485B). Spillville-Buckney complex soil is fine alluvium with a gentle to moderate slope (2-5%) on the narrow flood plains of tributary streams. The upper level (0-17 inches) pH of this soil unit is 6.6-7.8 which is mildly acidic to mildly basic. Due to its location, modern corn yield estimates are not given. This soil may have potential value for small-scale, unmechanized horticulture. This soil unit is not on any mapped Great Oasis component site in the Boone County study area or their adjacent TH. Spillville-Buckney complex is adjacent to Noah Creek Kiln (13BN111) and Old Moser (13BN130) at TI.



## Lower South Raccoon River Valley Locality (Dallas County)

## Soils at or Adjacent to Great Oasis Sites

Clarion loam (169B). Clarion loam is gently to moderately sloping (2-5%) and is derived from prairie vegetation on glacial till in upland locations. The pH of this soil unit at the upper level (0-18 inches) is 5.6-7.3 which is moderately acidic to mildly basic. Under current modes of cropping, the yield estimate for bushels of corn per acre is 110. 13DA53 is located on Clarion loam at a Wisconsin-aged upland. Due to the lack of metal horticultural implements to work prairie vegetation, it is doubtful if the Great Oasis people used this location for cropping.

Cylinder loam (203). Cylinder loam is located on stream terraces underlain by 32-40 inches of sand and gravel with a slope of 0-2%. It is comprised of alluvium derived from prairie grasses. The upper level (0-23 inches) pH is 5.6-7.3 which is moderately acidic to mildly basic. The only location for Cylinder loam associated with a Great Oasis component in the Dallas County study area is on the high terrace to the northwest of Maxwell (13DA264).

Hanlon-Spillville complex, channeled (1314). Hanlon-Spillville complex soils are nearly level (0-2% slopes). This complex is typical alluvial flood plain soils which are strongly representative of the Camp Creek Member of the DeForest Formation and probably post-date Great Oasis occupation. The Hanlon sub-unit in its upper level (0-30 inches) has a pH of 6.7-7.3 which is mildly acidic to mildly basic. The Spillville sub-unit has a pH of 5.6-7.3 in its upper level (0-44 inches) which is moderately acidic to mildly basic. The Hanlon-Spillville complex is associated with the referenced Dallas County Sites on at TL. These sites include: 13DA37,



13DA53, DeCamp (13DA64), Windmill Village (13DA112), Keufner (13DA126), and Maxwell (13DA264).

Ladoga silty clay loam (76C2). Ladoga sandy clay loam is moderately sloping (5-9%) and is formed in loess from up-slope alluvium. The pH of the upper level (0-8 inches) is 6.1-7.3 which is mildly acidic to mildly basic. Corn yield estimates using modern agricultural methods is 105 bushels per acre. The single example of this soil unit on a site with a confirmed Great Oasis site is the TH on 13DA37.

Nevin silty clay loam (88). Nevin silty clay loam is derived from fine alluvium on stream terraces that is nearly level to gently sloping (0-2%). The pH of this soil unit at the upper level (0-24 inches) is 5.6-7.3 which is moderately acidic to mildly basic. The estimate for corn yield using current agricultural practices is 114 bushels per acre. In the confirmed Great Oasis component sites in the Dallas County study area, Nevin silty clay loam is not on any mapped sites and adjacent to only 13DA264 at TH.

Nodaway silt loam (220). The level to gently sloping (0-2%) Nodaway silt loam is fine alluvium derived from prairie grasses and is found on TI and TL of the Dallas County study area. The upper level (0-60 inches) pH is 6.1-7.3 which is mildly acidic to mildly basic. The corn yield estimate using modern agricultural methods is 110 bushels per acre. Nodaway silt loam is significant to this study. Of the sites in the Dallas County study area with a confirmed Great Oasis component, Nodaway silt loam is on the mapped sites of Harmon College (13DA107), Kuehn (13DA110), and Maxwell (13DA264). This soil type is on 33% of confirmed Great Oasis sites in the study area. Nodaway silt loam is not found on TH in this locality. Even

more telling is the significance of Nodaway silt loam on TI adjacent to or in association with confirmed Great Oasis component site. In this context, Nodaway silt loam is found associated with 13DA37, 13DA53, DeCamp (13DA64), Harmon College, Kuehn, Windmill Village (13DA112), Keufner (13DA126), and Maxwell at TI. This is 89% of the referenced sites. Nodaway silt loam is found associated with Landis (13DA12), Harmon College, and Kuehn at TL. These soil units may possibly have been developed or redeposited after Great Oasis occupation. However, if the chronology for the development for Nodaway silt loam is uniform throughout the area, this places Nodaway silt loam associated with 100% of confirmed Great Oasis sites in the Dallas County study area.

Nodaway silt loam, channeled (1220). Nodaway silt loam is nearly level (0-2% slope) fine alluvium on active flood plains and first bottoms. This soil type has a very strong resemblance to the Camp Creek Member of the DeForest formation and probably post-dates Great Oasis occupation in the Dallas County study area. Due to its location and susceptibility to flooding, modern corn yield estimates are not given. In the upper level (0-60 inches, the pH is 6.1-7.3 which is mildly acidic to mildly basic. This soil unit is associated with Landis (13DA12) at TL.

Ridgeport sandy loam (823C). Ridgeport sandy loam is gently to moderately sloping (5-9%) and found on stream terraces and is comprised of sandy alluvium derived from prairie grass vegetation. The pH of the upper level (0-13 inches) is 5.6-7.3 which is moderately acidic to mildly basic. Modern corn yield estimates are 40 bushels per acre. In the Dallas County study area, Ridgeport sandy loam is not found directly on confirmed Great

Oasis component sites and is only found in association with Maxwell (13DA264) at TH.

Terril loam (27B, C). Terril loam is derived from local alluvium on the foot slopes of uplands. These soil units are gently to moderately sloping (2-5%, 5-9%, respectively). At the upper level 0-30 inches, the pH of Terril loam is 6.1-7.3 which is mildly acidic to mildly basic. Using modern agricultural techniques the estimated corn yield is 113 to 118 bushels per acre. Terril loam is located directly on portions of mapped Harmon College (13DA107) and Kuehn (13DA110). These soil units are found at TH at Landis (13DA12), 13DA37, 13DA53, DeCamp (13DA64), Harmon College (13DA107), and Kuehn (13DA110). Terril loam is not found on TI of the sites of the Dallas County study area.

Wadena loam (308B). Wadena loam is fine alluvium underlain by 32 to 40 inches of sand and gravel found on stream terraces and underlain by sand and gravel. These soil units are nearly level to gently sloping (0-2% and 2-5%, respectively). The pH in the upper level (0-18 inches) is 6.1-7.3 which is mildly acidic to mildly basic. When using modern cropping techniques the annual estimate of corn per acre is 90-92. Wadena loam is associated in the Dallas County study area only at TH at Maxwell (13DA264) and not found on any mapped Great Oasis sites.

Wiota silt loam (7). Wiota silt loam is gently sloping (1-3%) and derived from silty alluvium on stream terraces. The pH of this soil unit at the upper level (0-18 inches) is 5.6 to 7.3 which is moderately acidic to slightly basic. The modern corn yield estimate for this soil unit is 110 bushels per acre. Landis (13DA12), Windmill Village (13DA112), Keufner (13DA126), and Maxwell (13DA264) have Wiota silt loam at TI on the mapped

site locations with confirmed Great Oasis components. In the Dallas County study area, Wiota silt loam is not found at or adjacent to referenced sites at TH or TL.

Zenor-Storden Complex (829D2). Zenor-Storden complex is a mixed loamy soil unit found on steep side slopes (9-14%) of glacial outwash. This soil unit is derived from prairie grass vegetation. The Zenor-Storden complex is more easily described when divided into sub-units. The Zenor sub-unit at its upper level (0-11 inches) has a pH of 5.6-7.3 which is moderately acidic to mildly basic. The Storden sub-unit at its upper level (0-7 inches) has a pH of 7.4-8.4 which is mildly basic to moderately basic. The collective present-day corn yield estimate is 62 bushels per acre. The Zenor-Storden complex is not found on any referenced Dallas County sites and is associated with 13DA53 and DeCamp (13DA64). Both sites are located in Wisconsin-aged uplands. 13DA53, although having a confirmed Great Oasis component, is positioned nearer to DeCamp (a confirmed Great Oasis burial on the same upland) than the lower elevation habitation site of the next-nearest confirmed Great Oasis habitation site (Maxwell [13DA264]). The interpretation is Zenor-Storden complex soil probably had a marginal value for Great Oasis horticulture in the Dallas County study area due to its prairie location.

## CHAPTER 8. COMPARATIVE STUDIES

In this chapter the settlement model will continue through analogy in two ways. The first approach will be to study environmental and settlement models provided in other published archaeological reports that address similar types of questions. The second method is through ethnographic studies of historic Native Americans. In the latter, the manner of resource exploitation will be explored. A rough analogy can then be drawn on the probability and level of resource use by the prehistoric Great Oasis people.

## Vegetation Resources

Chapter 5 gives a clear picture of the varied vegetation communities available to the Great Oasis people as defined in the archaeological record and modern ecological analogies locally and regionally (Baerreis 1970; Baerreis and Bryson 1965; Doershuk and Finney 1995, 1996; Finney et al. 1994; Green 1995; Henning 1968; Mead 1981; Morrow et al. 1999; Semken and Falk 1987; Theler 1987; Tiffany and Alex 1999). It is beyond the scope of this project to give a complete compendium of potential floral resources used by the Great Oasis people in the study area but rather to note generally the types of vegetable food resources available beyond those derived from agriculture. The analysis presented by Zawacki and Hausfater (1969) (Table 5) has been distilled by selecting some key plant species found in the study area that would have potentially important as food sources to the Great Oasis people of central Iowa. Additional plant species known to be present in the study area were added to original list provided

Table 5. Potential food-bearing vegetation resources in the Noah's Bottom and Lower South Raccoon River Valley localities. (Derived from Zawacki and Hausfater 1969; Eilers and Roosa 1994; and Angier 1974)

Plant Name		Food Value
<i>Acer negundo</i>	box elder	boiled sap for syrup
<i>Acer nigrum</i>	black maple	boiled sap for syrup
<i>Amaranthus spp.</i>	pig weed	seeds
<i>Ambrosia trifida</i>	giant ragweed	seeds, greens
<i>Amelanchier arborea</i>	June berry, service berry	fresh berries
<i>Amphicarpa bracteata</i>	hog peanut	seeds
<i>Apios americana</i>	ground-nut	tuber
<i>Aquilegia canadensis</i>	columbine	roots
<i>Arisaema triphyllum</i>	jack-in-the-pulpit	tuber
<i>Asarum canadense</i>	ginger	roots
<i>Asclepias syriaca</i>	common milk weed	young shoots
<i>Asclepias tuberosa</i>	butterfly milk weed	young shoots
<i>Aster spp.</i>	asters	seeds, leaves
<i>Celastrus scandens</i>	climbing bittersweet	cambium
<i>Celtis occidentalis</i>	hackberry	seeds
<i>Carex spp.</i>	sedge	seeds, stems, tubers
<i>Carya ovata</i>	shagbark hickory	nuts
<i>Chenopodium berlandieri</i>	goosefoot, lamb's quarter	seeds, greens
<i>Claytonia virginica</i>	spring beauty	shoots, corms
<i>Cornus racemosa</i>	gray dogwood	berries
<i>Corylus americana</i>	hazelnut	nuts
<i>Crataegus spp.</i>	hawthorn	fruits
<i>Cyperus esculentus</i>	yellow nut grass	tubers
<i>Dentaria laciniata</i>	pepperroot	roots
<i>Dicentra canadensis</i>	squirrel corn	tubers
<i>Elymus canadensis</i>	Canada wild rye	seeds
<i>Eragostis pectinacea</i>	love grass	seeds
<i>Erythronium albidum</i>	dog-tooth violet	shoots, leaves
<i>Fragaria virginiana</i>	wild strawberry	fruits
<i>Fraxinus pennsylvanica</i>	green ash	cambium
<i>Gymnocladus dioica</i>	Kentucky coffee tree	seeds for beverage
<i>Humulus lupulus</i>	common hop	hops
<i>Laportea cylindrica</i>	wood nettle	greens if steamed
<i>Juglans cinerea</i>	butternut	nuts
<i>Juglans nigra</i>	walnut	nuts
<i>Malus ioensis</i>	Iowa crab apple	fruit
<i>Morus rubra</i>	mulberry	berries
<i>Onoclea sensibilis</i>	sensitive fern	fresh greens
<i>Oxalis stricta</i>	yellow oxalis	fresh greens



Table 5. (continued)

Plant Name	Food Value
<i>Petalostemum purpureum</i>	prairie clover
<i>Physalis</i> spp.	ground cherry
<i>Podophyllum peltatum</i>	mayapple
<i>Polygonatum</i> spp.	Solomon's-seal
<i>Polygonum</i> spp.	knot weed, smart weed
<i>Prunus americana</i>	prairie plum
<i>Prunus serotina</i>	black cherry
<i>Prunus virginiana</i>	chokecherry
<i>Quercus alba</i>	white oak
<i>Quercus macrocarpa</i>	bur oak
<i>Ribes missouriense</i>	gooseberry
<i>Rhus glabra</i>	smooth sumac
<i>Rhus typhina</i>	stag horn sumac
<i>Rorippa palustris</i>	march cress
<i>Rubus allegheniensis</i>	blackberry
<i>Rubus occidentalis</i>	black raspberry
<i>Sagittaria latifolia</i>	duck potato
<i>Sambucus canadensis</i>	elderberry
<i>Smilacina racemosa</i>	false Solomon's-seal
<i>Smilax rotundifolia</i>	greenbriar
<i>Tilia americana</i>	basswood
<i>Typha</i> spp.	cattail
<i>Ulmus rubra</i>	slippery elm
<i>Urticadioica</i>	stinging nettle
<i>Uvalaria grandiflora</i>	bellwort
<i>Verbena hasata</i>	blue vervain
<i>Vitis riparia</i>	riverbank grape
	seeds
	fresh berries
	fresh fruit
	berries
	seeds
	fresh fruit
	fresh fruit
	fresh fruit
	acorns if processed
	acorns if processed
	berries
	seeds
	seeds for beverage
	fresh greens
	berries
	berries
	tuber
	berries
	berries
	tuberous roots
	leaf buds
	tubers, pollen, shoots
	cambium
	greens if steamed
	seeds
	seeds
	fresh fruit

by Zawacki and Hausfater. Table 5 shows the variety of potential food sources provided by local vegetation.

The Great Oasis people of the study area inhabited basically a localized forest community with adjacent savannas and grasslands. Therefore, ethnographies of Great Lakes and eastern woodland cultures are a close approximation. There are several notable exceptions. Paper birch (*Betula papyrifera*) is native well to the north of the study area (Brockman 1968:102) and therefore birch bark use by the Great Oasis people would be



highly unlikely. Another tree found to the east of the study yet still within the prairie peninsula is the American chestnut (*Castanea dentata*) (Brockman 1968:116). The nuts provided high quality food for animals and humans alike (Petrides 1988:154-155). American chestnut has not been identified in the archaeological record at Great Oasis sites.

The vegetation resources of the area have been ethnographically documented. Various native plants were used seasonally as food, medicine, for ceremonial purposes, for smoking, for dyes, and for other utilitarian purposes (Yarnell 1964:44).

It is beyond the scope of this study to prepare an exhaustive compendium of aboriginal plant usage. Several of the plants with the most probable economic value will be highlighted. In general terms, spring shoots such as nettles and spring beauties (*Claytonia virginica*) are first to emerge. In late spring food sources such as gooseberries, strawberries, mulberries, and June berries become available. In mid to late summer, grass and composite seeds can be harvested as well as raspberries, blackberries, and black and choke cherries. *Chenopodium* leaves become available as a leafy green at this time. In late summer plums and grapes become available. Nuts (several varieties of acorns, walnuts, butternuts, hickory nuts, and hazelnuts) become available in autumn. Tubers (*Sagittaria*, ground-nut) can be harvested whenever ground or aquatic conditions permit.

Oaks (*Quercus* spp.) are common in the study area today as well as in the time of Great Oasis occupation. There is ample ethnographic evidence (Yarnell 1964) to assume acorns were processed and consumed by the Great Oasis people. The crop of acorns is not predictable and yearly abundance of acorns cannot be assumed. The lack of acorn evidence at Great Oasis sites

in the study area may be due to the processing required to make them palatable (Yarnell 1964:70) which may have been conducted away from house locations. Secondly, fragile acorn husks and caps may not preserve well in the archaeological context. As noted, evidence of hickory, walnut, butternut, and hazelnuts have been recovered at Great Oasis sites in the study area.

### Faunal Resources

As noted earlier, the faunal record at Great Oasis sites in the study area is incomplete for a number of reasons. Other archaeologists have undertaken faunal resource analysis and have found limitations in the record similar to those found in this study (Baerreis 1970; Morrow et al. 1999; Semken 1973; Styles 1981; Theler 1987). Styles (1981:80) prefers to not commit to precise estimation of faunal population but rather to explain faunal resources as simply being "available." This is the most realistic appraisal of faunal resources in the study area.

Detailed faunal assemblages were recovered from the Broken Kettle West site (13PM25) (Baerreis 1970), the Cowan site (13WD88) (Morrow et al. 1999) and the Apple Creek site (Parmalee, Paloumpis, and Wilson 1972) of the Lower Illinois valley. The assemblages of Cowan and Broken Kettle West (both from northwest Iowa) are remarkably similar. For the purposes of this study, animal remains from Cowan and Apple Creek will be compared. The faunal analysis of these sites will be used to draw theoretical parallels for the Great Oasis people of the study area. If a hypothetical line is drawn between these sites (approximately 570 kilometers apart) at a 45 degree angle passing from northwest through southeast Iowa, the central Iowa study area would be approximately 50 kilometers north of that line.

Although the study area is approximately 200 kilometers from Cowan and 370 kilometers from Apple Creek, *biologically* the study area is nearly equidistant between the more prairie-like conditions of Cowan and the more heavily forested, warmer and moister conditions at Apple Creek. The Apple Creek faunal remains are more varied than Cowan but the overall pattern of faunal resource exploitation shows some continuity. This is especially true in the White Hall phase at Apple Creek which is contemporaneous with Late Woodland in the study area.

The mammalian record of identified species at both sites is surprisingly similar. As expected, a limited amount of bison remains were recovered at Cowan with none being present at Apple Creek. At both sites elk was represented as a minor component. The most telling similarity in the mammalian record is the frequency of white-tailed deer remains found at both sites. In both cases, white-tailed comprise the highest percentage of large mammal remains. White-tailed deer represented 15.49% of identified faunal remains and the largest representative of ungulates (42% were deer) at Cowan (Morrow et al. 1999:307, 309) and 81.8% of identified mammals and 99% of all ungulates at Apple Creek (Parmalee et al. 1972:36). The frequency and variety of fish and bivalve remains are higher at Apple Creek than Cowan, but both sites show a clear indication of a reliance on aquatic protein sources. When viewed together, the composite lists of fish remains is a very close approximation of the fish present in the rivers and streams of central Iowa at the time of Euro-American settlement. During the White Hall phase at Apple Creek, in descending order, turkeys, unspecified ducks, geese (Canada and snow), and prairie chickens dominate avian remains recovered (Parmalee et al. 1972:33). At Cowan, geese dominate the

identified larger bird species (Morrow et al. 1999:307). At both sites the expected range of smaller mammals (canids, raccoons, rodents, etc.) currently found in the midwest were recovered. Morrow et al. (1999:301-302) notes that a small proportion of rodent bones show evidence of burning, giving evidence to small mammals having at least a minor contribution to the Great Oasis diet at the Cowan site.

The breakdown of potential meat as food for the Apple Creek site is given by Parmalee et al. (1972:54-59) with some reservations by the authors. They explain their estimations of food potential is approximate but does give credible support to the relative importance of some animal species as a food source over others. By extrapolating average meat yields per species and the minimum number of individuals of a species represented, they concluded approximately 55% of the potential meat resources came from mammals (46% from white-tailed deer alone), 40% from fish and freshwater mussels, 3% from birds, and 1% from turtles.

Baerreis (1970:14) calculated the approximate weight of meat by pounds based on the faunal remains recovered from nine excavated refuse pits at Broken Kettle West. From these remains an estimated 3,265 pounds of meat (1,479 kilograms) (94% of total) came from mammals, 158 pounds (71 kilograms) (5% of total) were derived from birds and 28 pounds (13 kilograms) (1%) came from fish. Although these estimations are certainly open to interpretation, they do show the relative importance of these protein sources.

There is varied ethnographic interpretations of the consumption of meat by aboriginal Native Americans. Wissler (1966:245-246) estimated the average daily consumption of meat per day by Native Americans was

approximately two pounds (0.91 kilograms) per day. Other than giving basic comments on nutrition, he does not explain how this figure was derived. McCabe (1982:89) presented some ethnographic information based on early trappers' records, which conclude as much as four pounds (1.8 kilograms) may have been consumed daily. McCabe suggests a compromise and considers three pounds (1.4 kilograms) of meat daily as a reasonable figure.

McCabe (1982:89-93) synthesized the estimations of Wissler (1966) and Fahey (1974:20) to estimate the necessary harvest of bison, deer, and elk for a given time for 100 Native Americans (Table 6). McCabe realistically included in the category of potential food, internal organs and viscera that unquestionably had food value but are generally not considered "meat" per se. There are some cautionary weaknesses in these estimations. These figures are based on the 1.4 kilograms of meat consumption as previously stated. This may or may not be accurate. The average size of these large animals vary with age, sex, season, and available food. The "deer" in the table presumably are an average of white-tailed and the slightly larger mule deer. The elk in this table are the current Rocky Mountain variety which is a close approximation to the extirpated plains and woodland varieties. The greatest need for interpretation in McCabe's analysis is the percentage of meat consumed by species. McCabe contends these figures are hypothetical maximum harvest numbers assuming that a single species provides 100% of the human population's protein needs. As the archaeological evidence of Apple Creek suggests, mammals of all kinds probably provided only about 55% of protein needs. At the Cowan site, mammal bones represent 61% of the faunal remains (Morrow et al. 1999:300).



Table 6. Approximate maximum number of mature ungulates hypothetically necessary to support a band of 100 Native Americans based on 1.4 kilograms (3.0 Pounds) per person per day (McCabe 1982:89)

Species	Approximate mean live weight		Approximate food yield		Number of animals needed per period of time			
	kg	lbs.	kg	lbs.	Day	Week	Month	Year
Bison	627.5	1,328	425.4	937	0.32	2.2	9.7	116.9
Deer	74.9	165	52.2	115	2.60	18.2	79.0	949.0
Elk	272.4	600	184.8	507	0.73	5.1	22.2	266.5

In summary, through the interpretation of ethnographic and archaeological data, at least 50% the animal protein needs of the Great Oasis people were probably met through hunting mammals with the major contribution coming from white-tailed deer. Based on archaeological parallels, the non-mammal animal protein (fish, birds, bivalves, reptiles, and amphibians) consumed by Great Oasis people was probably slightly under 50%. The actual percentage of protein sources used by the Great Oasis people probably lies somewhere between the values found at the Great Oasis component at Cowan and the White Hall phase at Apple Creek.

Ethnographic evidence clearly shows large game animals supplied not only food but by-products as well. Tanned hides were used for clothing and receptacles. Raw hide served for containers, drum heads, thongs, etc. Bones and antlers were modified to be used as tools. Sinews provided fiber for cordage and bladders and paunches were used for containers. Hooves and dew claws were used for glues and as rattlers for musical instruments (Wissler 1966:247).

## Agriculture

The ethnographic reports of indigenous agriculture among Native Americans in the upper midwest show a high degree of variability. In the study area there are no ethnographic studies of native agriculture prior to removal or forced migration westward. Most of the reliable available documentation comes from the upper Missouri River from Will and Hyde (1917). Their study was conducted with reservationized Native Americans (Arikara, Hidatsa, Mandan, Pawnee, Ponca, Santee Dakota, and others) in the 19th century. Another valuable contribution came from Gilbert Wilson (1917) as he documented the life of Buffalo Bird Woman (Maxi'diwiac), an elderly Hidatsa woman who gave first-hand accounts of the pre-reservation life of her youth along the Missouri River. These studies have strengths and weaknesses as they relate to this thesis. The documentation of these ethnographies was completed after the informants received metal tools and in some cases could have been employing Euro-American farming techniques. This could have potentially increased yields. Secondly, most of these studies were conducted to the west and north of the current study area. The regions are cooler and dryer than the study area implying some possible differences in the farming techniques and the varieties of crops used by historic Native Americans as opposed to the presumed methods of the Great Oasis people. These are not perfect analogies but are the best available. These studies are relevant because they show roughly the amount of land under cultivation needed to support a family or larger segment of a population. The relative investment in labor is implied. These ethnographies also show the manner of agriculture influenced by a tradition of subsistence farming. In an older but closer example, field burning prior



to planting was noted by Charlevoix (1966:239) among the Illinois in 1721. Additionally, these ethnographies show the variety of crops grown in companion with hills of maize. These would include various strains of maize, squash, beans, and sunflowers. These ethnographies show no references to *Chenopodium*.

Maxi'diwiac's largest field measured approximately 90 x 180 yards (Wilson 1917:24-25). This equates to about 13,544 square meters or 1.35 ha (3.34 acres). This field supported an extended family of 10 individuals. Prince Maximilian reported around 1832 that among the Mandan "each family prepares 3, 4, or 5 acres" (1.2, 1.6, 2 ha) (Will and Hyde 1917:99). Will and Hyde (1917:99) estimate that a mature woman with some help from children or elders worked plots averaging from 2.5 to 3 acres (1-1.2 ha). In polygynous marriage arrangements, this estimation may be higher.

The yield from these fields is subjective and open to interpretation. Unlike modern monoculture farming practices, the smaller Missouri Valley plots had several crops growing in companion with maize. Therefore, when bushels of corn per hectare are given as a statistic, the same land is providing other crops such as squash, beans, and sunflowers as well. It is probable that the Great Oasis people were using the same cropping strategies and including cultivars of native plants such as *Chenopodium spp.* Lowie (1985:19) cites George Will and George Hyde and their crediting the Santee Sioux of Minnesota as harvesting 25 5/7 bushels of maize per acre (63.5 per ha) in the productive growing year of 1878. Upper Missouri Valley villagers could be expected to produce on average about 20 bushels of maize per acre (approximately 49 bushels per ha). After examining former fields used by the Sauk in southeastern Iowa during the first half of the

nineteenth century, J. P. Walton (1893:229) estimated maize production at 30 to 40 bushels per acre (74-99 bushels per ha). This estimate would probably exceed Great Oasis maize yields due to the probable multiple and companion cropping strategies they most likely employed as evidenced by the high percentage of *Chenopodium* seeds found at Great Oasis sites in the study area.

In the study area, the preserved seeds of cultivars are the strongest archaeological evidence of agriculture. The scapula hoe is commonly referenced in ethno-historic literature as an implement of cultivation (Holder 1991; Lowie 1982:19-20; Wilson 1917:12-15). This tool is referenced throughout the upper midwest within the archaeological context as well (Gradwohl 1978:43-44; Lehmer and Jones 1968). Broihahn (1997) has identified scapula fragments from the Blosser site (13BN125) as portions of hoe blades based on wear patterns and alterations to the original scapula. The Blosser site has not been identified as a Great Oasis site according to the criteria of this study although it is directly up-slope from Old Moser (13BN130) which does have a confirmed Great Oasis component. Therefore, the use of a scapula hoe by the Great Oasis people cannot be conclusively ruled out in the study area but its use in the localities of the study remains unverified. The Great Oasis Wedge Lip ceramic vessel may be another indirect indication of agriculture. The thickened, reinforced design of the rim may support the hypothesis that this pot could have served as a storage vessel for seeds or grain. A soft or wet hide could be stretched over the orifice and be secured by lashing a cord around the circumference. The cover and the cord would be held securely in place by the outwardly protruding wedge on the lip of the vessel. Cache pits are another means to

store agricultural goods. Maxi'diwiac (Wilson 1917:87-97) gave explanations on the construction, size, and contents of a cache pit. Cache pits in the study area have been located at Kuehn (13DA110), Maxwell (13DA264), and Meehan-Schell (13BN110) but their frequency is less than what usually occurs on Mill Creek (Alex 1980: 133-134) or Oneota sites (McKusick 1973:95-114).

### Human Populations

The overall pattern of Great Oasis settlement appears to conform with some early Neolithic Period settlements in Europe (Whittle 1985:82) wherein small clusters of houses were dispersed within a region. The availability of local food appears to be in part a factor in site location. Fishing may have been done seasonally, but fish in general would be a constant source of food if necessary. Due to the smaller size and the meandering of the South Raccoon River, fishing may have been more convenient there as opposed to the Des Moines River. The abundance of deer appears to be more of a controlling factor of the distance between sites. The trend for Great Oasis settlement is unfortified, non-nucleated, small farming hamlets dispersed along a major water course. The thin scattering of cultural debris, the lack of deep middens, the lack of fortifications, and the lack of large conglomerations of houses reinforce the idea of a dispersed occupation over a relatively short span of time.

Population estimates of prehistoric Native Americans are speculative at best. Ethnographic data in the form of population estimates are determined from historic tribal affiliations. The physical manifestations of the Great Oasis culture show striking similarities over space. The logical assumption is they are a single ethnic group. This assumption is

yet to be verified and may never be determined. If the span of the Great Oasis culture is as brief as 150 years as Tiffany and Lensink purport, it is probable that the widely distributed Great Oasis sites are at least in part contemporaneous. The spatial distribution of Great Oasis sites is similar to those of the Pawnee to the west and Kickapoo to the northeast and the Illinois to the east although the Illinois appear to have occupied a larger home range. In the 17th and 18th centuries the Ioways' home territory was much of modern Iowa with settlements on major river valleys (such as the Upper Iowa) not unlike the Great Oasis people. By the early 19th century, the Ioways occupied much of the southern half of Iowa and the northwestern one-third of Missouri (Blaine 1995). With all this territory, their population probably never exceeded 1,500 (Blaine 1995:136). Mooney estimated the populations of the Kickapoo at 2,000 at the time of European contact. His estimates for the collective Illinois and Peoria is 8,000 for the same time period (Ritzenthaler and Ritzenthaler 1983:13). The native population density of the study area according to Driver and Massey (Driver 1969:Map 6) is 10-25 persons per 100 square kilometers. As the Great Oasis people settled in non-nucleated village units in the localities of the study area, large expanses of prairie and savanna were without human settlement. Considering the extent of territory occupied by historic Native Americans in the study area and the region at large, and their respective populations, it is reasonable to estimate through a rather imprecise parallel, the total population of the Great Oasis culture in the upper midwest to be not greater than 3,000 and not less than 1,000.

## CHAPTER 9. ANALYSIS AND CONCLUSIONS

This study has reviewed three parameters which are interrelated and have a direct bearing on the environmental conditions of central Iowa during the occupation of the Great Oasis people.

## Soil Analysis

The alluvial soils in the valleys of the Noah's Bottom, Lower South Raccoon River Valley and the hypothetical Walnut Creek localities are similar. This is due to their origins being comparable in climate, vegetation cover, parent material, topography, and the residual effects of glaciation.

The age and context of the formation of soils at the low terrace (TL) is a matter open to interpretation. Clearly, some proportion of the modern soils in the active floodplains of the Des Moines and South Raccoon valleys is recent Camp Creek member of the DeForest Formation. However, some soil types such as Nodaway silt loam at, or in association with the Dallas County sites, can be found on the intermediate terrace and the low terrace. The Noah's Bottom locality floodplain soils within the 1-kilometer site-catchment areas are exclusively Buckney fine sandy loam, channeled, 0-2% slopes. This may represent some recent deposition but may also overlay older alluvial soils (E. Arthur Bettis 1999: personal communication). The Great Oasis had access to, and probably used, the active floodplain for some planting. When the Des Moines and Raccoon Rivers down cut circa 750 BP, these former flood plains became the new TL. The TL is still prone to flooding today. In the analysis of the Boone and Dallas County localities'

soils that had potential economic value to the Great Oasis people, the aggregate of TL and TI probably most accurately reflects the amount of arable land available to them.

In the Noah's Bottom locality, several soil types within 1 kilometer of the referenced sites stand out as being preferred by the Great Oasis people (Tables 1 and 2). As noted, Buckney fine sandy loam, channeled, 0-2% slopes is within 1 kilometer of all Noah's Bottom locality sites. The exact proportion of this soil unit that is Camp Creek member is not known but at least some portion was probably available to the Great Oasis people. The next most frequently found alluvial soil is Coland clay loam which is found in 73% of the 1- kilometer site-catchments at the Boone County sites. By modern agricultural standards, this is a rather productive soil type. Coland clay loam is however, not particularly well drained. This soil type lies exclusively on TI and on only 29% of the referenced Noah's Bottom locality sites. The logical interpretation is Coland clay loam was preferred as a nearby source for agricultural lands but not necessarily for the placement of habitation. Houses could have been up-slope of this soil type at TH and not competed for cultivation space. Moingona loam appears to be a preferred location for cultivation *and* habitation. This soil type is moderately well-drained and slightly more productive than Coland clay loam and lies wholly on TH. Moingona loam is found at 55% of the Noah's Bottom locality sites. Dickman fine sandy loam is found on equal percentages (27%) at TH and TI. Dickman fine sandy loam is a well-drained soil type found in elongated units on the upland side slopes of larger streams (Andrews and Dideriksen 1981:12). This soil type is only about half as productive as Coland clay loam or Moingona loam but may have had some function for



habitation areas due to its well-drained nature. Sattre loam (13BN40) is found at the same frequency as Dickman fine sandy loam and could have been used for cultivation.

In the Noah's Bottom locality the amount of potentially arable land is less significant than the type of soil available. This is a quality versus quantity issue. Since Buckney fine sandy loam, channeled, 0-2% slopes is ubiquitous along the Des Moines River, Coland clay loam shows the next closest correlation to Great Oasis settlements. The mean amount arable soil on the same side of the river of the referenced site within the 1-kilometer radius site catchment is 102 ha (252 acres) (Tables 7 and 8). Of this amount, 46 ha (115 acres) lies at TI and TL. Following Will and Hyde's (1917:99) estimation of area cultivated by an average family, a hypothetical 1-kilometer radius site-catchment without overlaps with other sites could supply the agricultural needs of approximately 39 families. If Maxi'diwiac's extended family (Wilson 1917:24-25) was of average size (10), this cultivated area could hypothetically support 390 people. Obviously, this is a gross deviation from reality. This number of people would quickly outstrip faunal and vegetation resources. This exercise simply demonstrates the probability exists that more than ample amounts of quality, productive land was available to sustain a more realistic (lower) population estimate. In the Noah's Bottom locality, 100% of the hypothetical 1-kilometer radius site-catchments overlap with at least one other site-catchment. Therefore, if any nearby sites were occupied contemporaneously the inhabitants may have had to share soil resources.



Table 7. Noah's Bottom locality (Boone County) soils acreage of arable land within 1 kilometer of site

	TH/TI/TL	TH/TI/TLSS	TI/TL	TI/TLSS
13BN27	391.250	145.625	123.250	106.250
13BN38	348.125	251.250	178.750	78.50
13BN40	333.570	159.375	188.750	106.25
13BN103	316.250	93.125	151.250	56.875
13BN110	396.875	393.750	206.250	203.250
13BN111	341.875	326.250	200.000	184.375
13BN113	388.125	268.750	114.375	35.000
13BN114	456.250	348.125	116.250	52.500
13BN121	530.625	486.250	297.500	253.125
13BN130	338.125	200.625	142.500	74.375
13BN203	292.500	108.750	180.000	111.875

Key:

TH/TI/TL High Terrace, Intermediate Terrace, Low Terrace  
 TH/TI/TLSS High Terrace, Intermediate Terrace, Low Terrace on same side  
 of river as referenced site  
 TI/TL Intermediate Terrace, Low Terrace  
 TI/TLSS Intermediate Terrace, Low Terrace on same side of river as  
 referenced site

Table 8. Noah's Bottom Locality (Boone County) Soil statistics acreage of arable land within 1 kilometer of site

	TH/TI/TL	TH/TI/TLSS	TI/TL	TI/TLSS
N of cases	11	11	11	11
Minimum	292.500	93.125	114.375	35.000
Maximum	530.625	486.250	297.500	253.125
Range	238.125	393.125	183.125	218.125
Mean	375.795	252.898	172.625	114.784
Standard dev.	68.460	125.812	53.103	69.636

Key:

TH/TI/TL	High Terrace, Intermediate Terrace, Low Terrace
TH/TI/TLSS	High Terrace, Intermediate Terrace, Low Terrace on same side of river as referenced site
TI/TL	Intermediate Terrace, Low Terrace
TI/TLSS	Intermediate Terrace, Low Terrace on same side of river as referenced site

The same types of analogies exist in the Lower South Raccoon River locality with some variations. At least one site, DeCamp (13DA64) is an upland burial and probably not a habitation zone. The adjacent Paardekooper site (13DA11) is not included in this study but there is a likelihood that both sites are, in fact, a single multi-component site. 13DA256 is also not included in this study but it may also represent a Great Oasis burial component. In the Noah's Bottom locality the mean amount of potentially arable soil on the same side of the river within 1 kilometer of a referenced site is 102 ha (253 acres) (Table 8). This figure represents soils at TH, TI, and TL. The average amounts of the soils meeting the same criteria in the Lower South Raccoon River is 63 ha (157 acres). This lower

amount is due to the respective valley sizes. The catastrophic glacial meltwater events cut the larger and deeper Des Moines valley. As in the Boone County sites, if all the potential arable soil in context with the Dallas County sites were placed into cultivation, the human population would be in excess of the environmental carrying capacity ad modeled by faunal and vegetation resources.

The same limitation in interpreting the TL soils of the Noah's Bottom locality exists in the Lower South Raccoon River locality (Tables 9 and 10). The Dallas county sites do show more variability at TL. Established soils (Nodaway silt loam) can be found at TL in the same site-catchment as Nodaway silt loam, channeled and Hanlon-Spillville complex, channeled which appear to have elements of the Camp Creek member of the DeForest Formation.

The correlation of site location and soil types in the referenced sites of Dallas County is significant. The productive, well-drained Nodaway silt loam (Dideriksen 198334-35) is found within 89% of 1-kilometer radius site-catchments and is found in the site-catchments of 100% of habitation zones of verified Great Oasis sites of this locality (Tables 4, 9, 10). The next most frequently found soil type meeting the specified criteria in the locality is Wiota silt loam. Wiota silt loam is equally as productive as Nodaway silt loam. This soil type is located at 44% of the referenced Dallas County sites at TI and may have served for both planting and habitation.

Table 9. Lower South Raccoon River Valley locality (Dallas County) soils acreage of arable land within 1 kilometer of site

	TH/TI/TL	TH/TI/TLSS	TI/TL	TI/TLSS
13DA11	305.625	139.375	128.125	100.000
13DA37	296.875	140.625	136.250	83.750
13DA53	330.625	109.375	159.375	75.000
13DA64	392.500	136.250	193.750	63.125
13DA107	149.375	96.250	88.125	46.875
13DA110	134.375	92.500	96.250	45.625
13DA112	283.750	197.500	217.500	117.500
13DA126	284.375	201.250	176.875	112.500
13DA264	503.125	303.125	281.875	92.500

Key:

TH/TI/TL	High Terrace, Intermediate Terrace, Low Terrace
TH/TI/TLSS	High Terrace, Intermediate Terrace, Low Terrace on same side of river as referenced site
TI/TL	Intermediate Terrace, Low Terrace
TI/TLSS	Intermediate Terrace, Low Terrace on same side of river as referenced site

In summary, Noah's Bottom and Lower South Raccoon River localities have productive alluvial soil types that could have been cultivated by the Great Oasis people. There are also comparable amounts of alluvial soils at TI and TL at the confluence of Walnut Creek and the Raccoon River in Polk County (hypothetical Walnut Creek locality). Since the quantity of potentially tillable soils appears to more than could be cultivated at a given time, the quality (productivity) of a soil type appears to be the operative variable. By identifying the soil types most closely correlated

Table 10. Lower South Raccoon River Valley locality (Dallas County) soil statistics acreage of arable land within 1 kilometer of site

	TH/TI/TL	TH/TI/TLSS	TI/TL	TI/TLSS
N of cases	9	9	9	9
Minimum	134.375	92.500	88.125	45.625
Maximum	503.125	303.125	281.875	117.500
Range	368.750	210.625	193.750	71.875
Mean	297.847	157.361	164.236	81.875
Variance	12672.667	4509.744	3779.080	698.730
Standard dev.	112.573	67.155	61.474	26.434

Key:

TH/TI/TL	High Terrace, Intermediate Terrace, Low Terrace
TH/TI/TLSS	High Terrace, Intermediate Terrace, Low Terrace on same side of river as referenced site
TI/TL	Intermediate Terrace, Low Terrace
TI/TLSS	Intermediate Terrace, Low Terrace on same side of river as referenced site

with Great Oasis sites, on and off the Des Moines Lobe in central Iowa, insights can be gained for the location of sites yet to be discovered.

## Faunal Resource Analysis

The working model in interpreting the use of faunal resources is a combination of food preferences based on archaeological data (Baerreis 1970; Morrow et al. 1999; Parmalee et al. 1972) animal protein consumption based on ethnographic studies (McCabe 1982), and modern wildlife population estimates in the study area (Rolfes 1999).

Through ethnographic and archaeological analogies, the synthesis of these studies indicate an estimate of about 1.4 kilograms (3 pounds) of

animal protein consumed daily per person in the Great Oasis diet. Faunal evidence indicates large mammals (primarily white-tailed deer) supplied approximately 50% of animal protein needs. Therefore, a reasonable estimate of protein derived from white-tailed deer is about 0.7 kilograms (1.5 pounds) on average for daily consumption. This would equate to approximately 256 kilograms of protein supplied by white-tailed deer per person per year. Each 1-kilometer radius site-catchment has 3.14 square kilometers of surface area. With the conservative established carrying capacity of 8 deer per square kilometer, each 1-kilometer radius site-catchment should support about 25 white-tailed deer. According to McCabe's estimations of 52.2 kilograms (115 pounds) of usable food protein per deer, a site-catchment area could potentially provide 1,305 kilograms (2,875 pounds). If all the white-tailed deer were harvested in a single site-catchment, the site-catchment could only support 5 persons. A complete harvest of deer per site-catchment would be unsustainable. If a 50% harvest were reached, a site catchment could only support 2.5 persons (Table 11). To confound this analysis further, all Great Oasis site-catchments in the Noah's Bottom locality overlap with at least one other site catchment. In the Lower South Raccoon River locality, all but one (Landis 13DA12) site-catchment overlaps. In the case of Landis, if 13DA40 (a suspected Great Oasis site) was verified, all sites in the study area except the West Des Moines Burial (13PK38) have overlapping site catchments.

In order to reconcile the disparity in human carrying capacities based on soils versus faunal resources, various settlement models need to be reviewed. Table 11 shows the hypothetical 1-kilometer radius site-catchment would be insufficient to supply the food needs derived from white-tailed

Table 11. Estimated white-tailed deer maximum food yield potential based on a mean weight of usable food per animal at 52.2 kilograms (McCabe 1982:89) and eight deer per square kilometer (Rolfes 1999)

a(km)	b(sq.km)	c	d(kg)	e(kg)	f	g
1	3	24	1,253	256	5	2.5
2	13	101	5,248	256	21	10.5
3	28	226	11,807	256	46	23.0
4	50	402	20,991	256	82	41.0
5	79	628	32,798	256	128	64.0

Key:

- a. Radius of site-catchment in kilometers
- b. Area of site-catchment in square kilometers
- c. Estimated number of deer per site-catchment
- d. Estimated amount of usable food resources provided by deer per site-catchment in kilograms
- e. Estimated annual amount of usable food resources provided by deer consumed per person in kilograms
- f. Humans sustained by deer food resources per site-catchment
- g. Adjusted estimated human population for sustainable deer harvest (50%)

deer for a single family for a sustained period of time. This table demonstrates the "best fit" for a small hamlet of three or four extended families utilizing deer as a resource would be a site-catchment with a radius of 3 to 4 kilometers. There could be trade-offs for the Great Oasis people. Hunting expeditions by foot or watercraft could be mounted to exploit faunal resources well outside the hypothetical site-catchments but this would be an ever-increasing investment in time and labor and in the long run may not have been profitable. Additionally, if longer-ranged hunting took place, there would be the possible competition with other Great Oasis people in the same locality.



This analysis infers localized hunting. There may have been a symbiotic relationship between the Great Oasis people and the white-tailed deer. Although the agricultural fields of the Great Oasis people were very small in comparison to modern farm fields, they still probably attracted deer. It would be advantageous for the Great Oasis people to harvest deer close to home to reduce crop loss and avoid long hunting trips. The deer may have benefited by the presence of the Great Oasis people beyond simply feeding on their crops. As humans burn lowlands, remove or otherwise kill larger trees, forage for fuel, and allow fields to remain fallow, secondary herbaceous growth is encouraged. This creates preferred habitat for white-tailed deer. Large predators (primarily wolves) are by nature shy and retiring (Whitaker and Hamilton 1998:408). White-tailed deer may have found some sanctuary from wolves and mountain lions by maintaining a cautious proximity to humans.

### Spatial Analysis

The proximity of Great Oasis sites, as mapped, give the illusion of contemporaneous occupation (Figures 2 and 3). In the previous section, the interpretation suggests Great Oasis sites needed a much larger site-catchment to exploit faunal resources than soil resources. The spatial analysis is an artificial construct between close sites because their relative temporal aspects are not well understood. Some sites could be contemporaneous while others are not. The clustering of sites such as Meehan-Schell (13BN110), Noah Creek Kiln (13BN111), and Sparks (13BN121) is such an example. There is not a defined ceramic seriation (ceramic artifacts are similar) and a comparative set of calibrated radio-carbon dates is lacking.

The spatial analysis of the Great Oasis sites in this study area does have two strengths. The first strength is identifying common themes of Great Oasis sites in relation to geographical features. The second value to this analysis is in the location of yet to be identified Great Oasis sites, relative to known sites.

Chapter 3 gives a brief description of the eight spatial parameters measured and analyzed. The parameters were reviewed by locality. These data were then combined and reviewed collectively for the entire central Iowa study area. Tables 12 through 17 present data of spatial parameters investigated.

The distance to a navigable stream from a linear measurement (DNSL) and along a travel route (DSNT) were more or less the same measurement. This was true in both localities (Tables 13, 15, and 17). The mean distance for both localities was 287 meters. The mean value for Noah's Bottom locality was 321 meters and slightly less for the Lower South Raccoon River locality at 254 meters. The Des Moines Valley has a broader floodplain than the South Raccoon and the intermediate and high terraces are slightly further away from the river in Boone County. The value of this statistic is, in most cases, evident. Great Oasis sites are located high enough and far away enough from the river to reduce the probability of flooding but close enough to be within visual contact of the river and easy access to water. Of the 20 sites reviewed, only Meehan-Schell (13BN110) and Noah Creek Kiln (13BN111) were over 0.5 kilometer from the river. At these two sites, fresh water could be easily attained from Noah Creek or the closer Coal Valley Creek. Undoubtedly the rivers served as a water and food source

but also were also a means for transport and communication. Anyone traveling up or down the river could be easily hailed or intercepted.

The distance from a Great Oasis site to a feeder stream of the main river by linear measurements and presumed travel routes (DFSL, DFST) was also more or less the same measurement. These parameters were selected because tributary streams generally have cleaner water than the main river, and often have shoals at the confluence. These shoals provide habitat for freshwater mussels, a foundation for a fish weir, solid footing for access to the river, sheltered eddies, and a landmark. The mean distance from a site to a feeder stream over both central Iowa localities was remarkably similar. The Boone County sites averaged 423 meters and the Dallas County sites averaged 410 meters from a feeder stream. The interpretation of these data indicate it was preferable for Great Oasis people to live near feeder streams but more important to live closer to the river proper.

As noted, the distance between Great Oasis sites is problematic because it is not clearly understood if the sites referenced were contemporaneous. The faunal analysis and respective site-catchment estimates show contemporaneous occupation of all sites in a locality as unlikely. Other issues yet unclear are: the length of site occupation, or if the site was abandoned and later re-occupied. Because there are no deep middens located associated with Great Oasis occupation in the study area, or large and numerous cache pits, the impression is one of relatively short-term occupation on the order of years, up to a generation, but not on the order of multiple decades. Great Oasis sites in the study area typically show some stratification relative to earlier Late Woodland and Middle Woodland cultures but Great Oasis strata in themselves do not show

sequential occupation. If temporal aspects are placed aside, measurement to the nearest Great Oasis site can be valuable in locating additional Great Oasis sites in the referenced localities.

The distance to the nearest Great Oasis site by linear measurement (DNGOSL) or by a presumed travel route (DNGOST) do not show significant variation. There is a notable difference in these parameters when viewed between localities. Great Oasis sites in the Noah's Bottom locality are more tightly spaced between one another than in the Lower South Raccoon River Valley locality. The mean distance by linear measurement at the Boone sites is 0.62 kilometers compared to 2.43 kilometers in the referenced Dallas County sites. It should be noted that the Landis site (13DA12) is a statistical "outlier." There are no other sites in the study area with so much distance to the next Great Oasis site. The Two Cottonwoods site (13DA25), 13DA33, and 13DA40 are in the general vicinity of the Landis site but do not have confirmed Great Oasis components. If these three sites, upon further sub-surface testing, were confirmed to have Great Oasis components, the territory at the confluence of the Middle Raccoon and South Raccoon Rivers may constitute a "sub-locality" or perhaps a separate locality. The spatial parameters of the Lower South Raccoon River Valley locality were analyzed including and excluding the Landis site. Even when the data from Landis was omitted, the Dallas County sites showed a broader spatial separation than those of Boone County. These are potentially significant data. There appears to be a higher probability that the referenced sites in the South Raccoon valley constitute a shorter relative time span of occupation than those of the Des Moines valley due to the fewer overlaps in 1 to 5 kilometer hypothetical site-catchments.

The parameters of the distance to the focal point by linear measurement (DFPL) and presumed travel route (DFPT) were analyzed as an exercise to discover statistical consistencies between the two localities. The "focal point" as described in Chapter 3 is purely a hypothetical construct. It is assumed that the Great Oasis people were in some type of regular contact with their neighbors, friends, and families within a locality. DFPL and DFPT are parameters used to explain just how far Great Oasis people would disperse in a locality, yet still be in close enough proximity for communication and gathering if necessary. DFPT is probably the most realistic appraisal of distances tolerated for active communication. The composite mean value for both localities is 7.32 kilometers. The relatively spatially compacted Boone County sites have a value of 6.63 kilometers for DFPT and the Dallas County sites (including the distant Landis) have a value of 7.71 kilometers. These figures are interpreted in terms of human behavior. The Great Oasis people needed to spread out in order to not compete directly for resources but needed to be close enough to communicate and gather (for recreation, trade, ceremony, common defense, assistance, etc.) within several hours travel by foot or watercraft. It appears approximately 7 kilometers is the threshold of dispersal from the proposed focal point.

#### Theoretical Carrying Capacities

Of the parameters investigated in this study (soils, space, and fauna), the local populations of white-tailed deer, as modeled, appear to be the single most important factor in modeling Great Oasis populations in the study area.

Using the model for site-catchments, theoretical human carrying capacities for the separate localities can be drawn. The width of the gallery forest and probable adjacent savannas in the Noah's Bottom locality is approximately 6 kilometers. If a diagonal line is drawn from 3 kilometers northwest of Logansport (13BN103 to 3 kilometers southeast of Hubby (13BN38) the approximate length of the locality is 20 kilometers. This yields a hypothetical catchment for the locality of 120 square kilometers. This area would support approximately 960 white-tailed deer based on 8 per square kilometer. This population multiplied by McCabe's factor of an average of 52.2 kilograms of usable food per deer yields a potential food total of 50,112 kilograms for the locality catchment. When the total potential food value is divided by the approximate yearly consumption of food provided by deer (256 kilograms), the locality could support approximately 196 people if 100% of the deer were harvested. If a 50% sustainable harvest were employed, the Noah's Bottom locality would support about 98 people at a given time.

The same type of calculations can be drawn for the Lower South Raccoon River locality. The gallery forest and the presumed adjacent savannas along the South Raccoon River and its tributaries is approximately 4 kilometers in width. This is on average 2 kilometers narrower than the Noah's Bottom locality. Including 3 kilometers west of the Maxwell site (13DA264) and 3 kilometers east of the Landis site (13DA12), the linear arrangement of the Dallas County sites is 25 kilometers. This yields a locality catchment of approximately 100 square kilometers. Using the same formulae as Noah's Bottom, the Lower South Raccoon River Valley locality



can potentially support 163 people at a 100% deer harvest and 82 at a sustainable harvest of 50%.

The seasonal settlement model offered by Williams (1975) is drawn into question. She contends small farming hamlets were inhabited seasonally and the dispersed groups gathered in winter villages. This cannot be verified in the study area for several reasons. There is no evidence of a nucleated village pattern. Under a nucleated village configuration, evidence of numerous house structures in close proximity would be expected. As of yet, this has not been found. The logical locations of these hypothetical villages would be expected near the proposed focal points. If the permanent, semi-subterranean dwelling with wattle and daub walls and a thatched roof is a correct appraisal of a typical Great Oasis house, it would need year-round maintenance to remain sound. If the outlying settlements were abandoned in the winter, there would be little need of cache pits. However, the Kuehn site (13DA110) (a medium sized Great Oasis site) has strong evidence of a cache pit and probably a permanent house as well. If the population of nearly 100 people needed to heat 10 or more houses, the local fuel supply would become exhausted without long distance foraging for wood.

The number of inhabitants per Great Oasis site in the study area cannot be determined precisely through existing archaeological data. The best reasonable models are through faunal population estimates and analogy.

Assuming the carrying capacity for Great Oasis people is based primarily on white-tailed deer availability, the Great Oasis population would need to disperse in order to maximize harvest and minimize conflict with their neighbors. In the Noah's Bottom locality, if the modeled



population was divided into four smaller communities, a site would be expected to have about 25 persons living there at a given time. Table 11 shows this would be ample space for a 3- to 4-kilometer site-catchment under this configuration. In the Lower South Raccoon River Valley locality the modeled Great Oasis population is slightly smaller than the Boone County sites, but shows the overall general configuration by the spatial distribution of sub-populations. To summarize this section, according to this model, Great Oasis sites in the study area need a site-catchment of approximately 3 kilometers in radius (sites about 6 kilometers apart) in order to be sustainable and contemporaneous.

#### Application of Modeling Procedures

In the Noah's Bottom locality, there are reaches of the Des Moines Valley that have the necessary prerequisites for Great Oasis sites but have no identified Great Oasis components. One such location is 13BN202 which is approximately 1.5 kilometers south-southwest of the Old Moser site (13BN130). This location overlooks the Des Moines River from a high terrace, has Moingona loam on the proposed site, and ample quantities of Buckney fine sandy loam and Hanlon fine sandy loam in the hypothetical 1-kilometer radius site-catchment. As a test, the artifact collection from 13BN202 was reviewed. In this collection typical Middle and Late Woodland pottery fragments were collected through surface surveys and minimal subsurface testing. One sherd was from the juncture of a straight rim and the globular body of a well-made, thin vessel with tool impressions at the juncture. This sherd may be evidence of a Great Oasis component, but cannot be verified. More extensive sub-surface testing may confirm this as a Great Oasis site. A second suspect location in the Noah's Bottom locality would

be on the high terrace in the south-central portion of Section 29 in Marcy Township. This location is positioned on the west side of the river and is approximately 2.5 kilometers north-northwest of 13BN203. There is no registered site at this location. Moingona loam is on this hypothetical site, with more than ample Buckney fine sandy loam below it on the intermediate terrace.

In the Lower South Raccoon River locality, there is a notable absence of Great Oasis sites between the Harmon College site (13DA107) and Landis (13DA12) (a linear distance of 11 kilometers). The landforms, soils, and water resources indicate parameters preferred by the Great Oasis people for their settlements. An example is 13DA33 (see Chapter 6). This site was tentatively identified by Finney et al. (1994) as a Great Oasis site but based on ceramic review, was not included in the statistical analysis of this work. Nonetheless, this site is a likely candidate for Great Oasis confirmation due to its location on the upper portion of an intermediate terrace, and the site being located on and adjacent to large amounts of Nodaway silt loam, the single highest correlation for 1-kilometer radius site-catchments in the referenced Dallas County sites. Lensink (1999) has noted the lack of confirmed Great Oasis sites in this area may be due to the lack of in-depth surveys. If Great Oasis habitation did take place in this reach of river valley, it probably would not disrupt other site-catchments up or down stream due to its relative isolation.

#### Research Questions Revisited

At this point in the study, the research questions are revisited.

1. *Are there predictable landforms on which sites with Great Oasis components (habitation and burial) are located?* Several related landforms

were preferred for Great Oasis habitation. In the study area Great Oasis sites' habitation sites are located predominantly on Holocene alluvial terraces. The DeCamp burial site (13DA64) and nearby 13DA53 (with an ambiguous function) are in upland locations. The West Des Moines burial (13PK38), which was not included in the statistical analysis, is also an upland site. Five sites (25%) were located on high terraces (TH). The intermediate/high terrace (TI/TH) indicates a location of transition. Eight sites (40%) were located on this landform. The intermediate terrace was represented by four sites (20%). 13BN40 was located on a alluvial fan that overlays a high terrace and 13BN203 which is predominantly on an intermediate terrace with approximately 25% of the site on a alluvial fan. No sites in the study area were located on the low terrace (TL).

2. *What is the amount of potentially tillable land (using hypothesized Great Oasis horticultural techniques) within 1 kilometer of Great Oasis sites?* The 1-kilometer site catchments showed considerable variability between site-catchments and between localities. These data include area of arable soil at the low terrace (TL), intermediate terrace (TI), and high terrace (TH). The range per site-catchment in the Noah's Bottom locality was from 118 ha (293 acres) to 214 (531 acres) with a mean of 151 ha (376 acres). On the same side of the river as the site, the range per catchment was from 37 ha (93 acres) to 196 ha (486 acres) and a mean of 102 ha (253 acres). In the Lower South Raccoon River Valley locality the range per catchment was from 54 ha (134 acres) to 203 ha (503 acres) with a mean of 120 ha (298 acres). For these Dallas County sites the amount of potentially tillable soil on the same side of the river as the referenced site is a minimum of 37 ha (93 acres), a maximum of 78 ha (194 acres), and

a mean of 63 ha (157 acres). Ethnographic studies have shown an extended family of 10 people needed from 1.2 to 2 ha of cultivated fields for subsistence. There was ample land within the 1-kilometer site catchments to support agriculture.

a. *Are there predictable soil types at or adjacent to Great Oasis sites?* There are soil types that tend to be more commonly associated with Great Oasis sites at the site location or within the 1-kilometer radius site-catchment area.

In the Noah's Bottom locality (Tables 1, 2), Buckney fine sandy loam, channeled, is found on the low terrace at 100% of the 1-kilometer site-catchments. However, the amount the Camp Creek member of the DeForest Formation comprising this soil type is not known. The temporal aspects of the intermediate terrace are better understood. This landform was unquestionably present during Great Oasis occupation. At the intermediate terrace, Coland clay loam is found in 73% of 1-kilometer radius site-catchments, Buckney fine sandy loam at 55%, and Dickman fine sandy loam and Sattre loam each at 27% in site-catchments. Moingona loam is the most common soil type found on Great Oasis sites in the locality at a frequency of 55% for high terrace and site-catchment.

In the Lower South Raccoon River Valley locality, a similar condition exists regarding the context of the low terrace (Tables 3, 4). A minor variation is the existence of established soils (Nodaway silt loam) at 33% of referenced Dallas County sites at the low terrace. At the intermediate terrace, Nodaway silt loam is within the 1-kilometer radius site-catchment of 89% of the referenced sites. Wiota silt loam is the most frequently found soil type on the intermediate terrace of the referenced Dallas County

sites at 46% occurrence. Wiota silt loam is found exclusively on the intermediate terrace. The second most frequently occurring soil type occurs on the high terrace at 67% and is Terril loam. The next most frequently occurring soil at these sites is Nodaway silt loam with a 22% rate of occurrence.

3. *Is there a predictable spatial factor among Great Oasis sites?*

These sets of parameters are based on confirmed Great Oasis sites. It is probable that not all sites have been identified, separately designated sites may be in fact a single site, and some sites with questionable affiliation may be Great Oasis sites upon further investigation. Eight spatial parameters were selected. There was a strong consistency in both localities for locating a site about 287 meters from a major water course. The correlation of site location and proximity feeder stream was not particularly strong. The distance to the nearest Great Oasis site remains an artificial construct because there is a low probability that most or all sites were occupied contemporaneously. These data do show the resources of a given locality, coupled with a sense of cultural continuity, were sufficient to maintain a Great Oasis occupation over time. The Noah's Bottom locality sites are slightly more compacted with a mean distance of linear 0.62 kilometers between sites as opposed to the 1.53 linear kilometers between the sites of the Lower South Raccoon River Valley locality (Tables 12 through 17).

4. *What is the theoretical carrying capacity for white-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphas*) in the Noah's Bottom and Lower South Raccoon River localities in central Iowa?* Upon the review of Great Oasis and Late Woodland sites, the archaeological evidence shows elk

Table 12. Noah's Bottom (Boone County) spatial units expressed in kilometers

	DNSL	DNST	DFSL	DFST	DNGOSL	DNGOST	DFPL	DFPT
13BN27	0.259	0.259	0.353	0.353	0.542	0.542	2.100	3.718
13BN38	0.180	0.180	0.180	0.180	1.074	1.221	10.179	15.850
13BN40	0.335	0.335	0.335	0.335	0.580	0.580	2.168	3.336
13BN103	0.141	0.141	0.188	0.188	1.027	1.027	4.712	10.386
13BN110	0.778	0.778	0.778	0.778	0.254	0.254	0.405	0.405
13BN111	0.655	0.820	0.655	0.820	0.254	0.254	0.377	0.377
13BN113	0.125	0.125	0.528	0.528	0.358	0.358	1.960	4.335
13BN114	0.132	0.132	0.132	0.358	0.358	0.358	1.880	3.902
13BN121	0.457	0.613	0.457	0.613	0.471	0.471		
13BN130	0.368	0.368	0.641	0.461	0.834	0.834	4.251	9.640
13BN203	0.988	0.099	0.410	0.410	1.074	1.221	9.882	14.316

Key:

DNSL Distance to Navigable Stream, linear measurement  
 DNST Distance to Navigable Stream, probable travel route  
 DFSL Distance to Feeder Stream, linear measurement  
 DFST Distance to Feeder Stream, probable travel route  
 DNGOL Distance to Nearest Great Oasis Site, linear measurement  
 DNGOT Distance to Nearest Great Oasis Site, probable travel route  
 DFPL Distance to Focal Point, linear measurement  
 DFPT Distance to Focal Point, probable travel route



Table 13. Noah's Bottom (Boone County) spatial statistics expressed in kilometers

	DNSL	DNST	DFSL	DFST	DNGOSL	DNGOST	DFPL	DFPT
N of cases	11	11	11	11	11	11	10	10
Minimum	0.099	0.099	0.132	0.132	0.254	0.254	0.377	0.377
Maximum	0.778	0.820	0.778	0.820	1.074	1.221	10.179	15.850
Range	0.679	0.721	0.646	0.688	0.820	0.967	9.802	15.473
Mean	0.321	0.350	0.423	0.436	0.621	0.647	3.791	6.627
Variance	0.052	0.072	0.045	0.054	0.106	0.136	12.732	30.797
Standard dev.	0.228	0.168	0.212	0.233	0.325	0.369	3.568	5.550
Sum	3.528	3.849	4.657	4.798	6.816	7.120	37.914	66.271

Key:

DNSL Distance to Navigable Stream, linear measurement  
 DNST Distance to Navigable Stream, probable travel route  
 DFSL Distance to Feeder Stream, linear measurement  
 DFST Distance to Feeder Stream, probable travel route  
 DNGOL Distance to Nearest Great Oasis Site, linear measurement  
 DNGOT Distance to Nearest Great Oasis Site, probable travel route  
 DFPL Distance to Focal Point, linear measurement  
 DFPT Distance to Focal Point, probable travel route



Table 14. Lower South Raccoon River Valley locality (Dallas County) spatial units expressed in kilometers

	DNSL	DNST	DFSL	DFST	DNGOSL	DNGOST	DFPL	DFPT
13DA12	0.311	0.311	0.622	0.622	11.112	15.183	18.402	26.229
13DA37	0.160	0.160	0.160	0.160	0.806	0.806		
13DA53	0.193	0.193	0.773	0.773	0.372	0.372	1.056	1.056
13DA64	0.287	0.287	0.401	0.401	0.372	0.372	0.650	0.650
13DA107	0.382	0.382	0.429	0.429	2.097	2.653	6.937	11.300
13DA110	0.132	0.132	0.339	0.339	2.097	2.653	4.976	8.826
13DA112	0.113	0.113	0.113	0.113	2.474	3.072	3.398	4.133
13DA126	0.160	0.160	9.292	0.292	3.812	4.858	3.812	4.858
13DA264	0.052	0.052	0.330	0.622	0.806	0.806	0.806	0.806

Key:

DNSL Distance to Navigable Stream, linear measurement  
 DNST Distance to Navigable Stream, probable travel route  
 DFSL Distance to Feeder Stream, linear measurement  
 DFST Distance to Feeder Stream, probable travel route  
 DNGOSL Distance to Nearest Great Oasis Site, linear measurement  
 DNGOST Distance to Nearest Great Oasis Site, probable travel route  
 DFPL Distance to Focal Point, linear measurement  
 DFPT Distance to Focal Point, probable travel route

Table 15. Lower South Raccoon River Valley locality (Dallas County) spatial statistics expressed in kilometers

	DNSL	DNST	DFSL	DFST	DNGOSL	DNGOST	DFPL	DFPT
N of cases	9	9	9	9	9	9	8	8
Minimum	0.052	0.052	0.113	0.113	0.339	0.339	0.650	0.650
Maximum	0.754	0.754	0.773	0.773	11.112	15.183	18.402	26.229
Range	0.702	0.702	0.660	0.660	10.773	14.844	17.752	25.579
Mean	0.254	0.254	0.410	0.439	2.429	3.111	5.206	7.707
Variance	0.041	0.041	0.045	0.049	10.625	20.281	30.290	66.773
Standard dev.	0.202	0.202	0.213	0.229	3.260	4.503	5.504	8.171
Sum	2.544	2.544	4.100	4.392	24.287	31.114	46.851	69.361

Key:

DNSL Distance to Navigable Stream, linear measurement  
 DNST Distance to Navigable Stream, probable travel route  
 DFSL Distance to Feeder Stream, linear measurement  
 DFST Distance to Feeder Stream, probable travel route  
 DNGOL Distance to Nearest Great Oasis Site, linear measurement  
 DNGOT Distance to Nearest Great Oasis Site, probable travel route  
 DFPL Distance to Focal Point, linear measurement  
 DFPT Distance to Focal Point, probable travel route

Table 16. Central Iowa Study Area composite spatial units

	DNSL	DNST	DFSL	DFST	DNGOSL	DNGOST	DFPL	DFPT
13BN27	0.259	0.259	0.353	0.353	0.542	0.542	2.100	3.718
13BN38	0.180	0.180	0.180	0.180	1.074	1.221	10.179	15.850
13BN40	0.335	0.335	0.335	0.335	0.580	0.580	2.168	3.336
13BN103	0.141	0.141	0.188	0.188	1.027	1.027	4.712	10.386
13BN110	0.778	0.778	0.778	0.778	0.254	0.254	0.405	0.405
13BN111	0.655	0.820	0.655	0.820	0.254	0.254	0.377	0.377
13BN113	0.124	0.124	0.528	0.528	0.358	0.358	1.960	4.335
13BN114	0.132	0.132	0.132	0.132	0.358	0.358	1.880	3.902
13BN121	0.457	0.613	0.457	0.613	0.471	0.471	--	--
13BN130	0.368	0.368	0.641	0.461	0.834	0.834	4.251	9.646
13BN203	0.099	0.099	0.410	0.410	1.074	1.221	9.882	14.316
13DA12	0.311	0.331	0.622	0.622	11.112	15.183	18.402	26.229
13DA37	0.160	0.160	0.160	0.160	0.806	0.806	--	--
13DA53	0.193	0.193	0.773	0.773	0.372	0.372	1.056	1.056
13DA64	0.287	0.287	0.401	0.401	0.372	0.372	0.065	0.065
13DA107	0.382	0.382	0.429	0.429	2.097	2.653	6.937	11.300
13DA110	0.132	0.132	0.339	0.339	2.097	2.653	4.976	8.826
13DA112	0.113	0.113	0.113	0.113	2.474	3.072	3.398	4.133
13DA126	0.160	0.160	9.292	0.292	3.812	4.858	3.812	4.858
13DA264	0.052	0.052	0.330	0.622	0.806	0.806	0.806	0.806

Key:

DNSL Distance to Navigable Stream, linear measurement  
 DNST Distance to Navigable Stream, probable travel route  
 DFSL Distance to Feeder Stream, linear measurement  
 DFST Distance to Feeder Stream, probable travel route  
 DNGOL Distance to Nearest Great Oasis Site, linear measurement  
 DNGOT Distance to Nearest Great Oasis Site, probable travel route  
 DFPL Distance to Focal Point, linear measurement  
 DFPT Distance to Focal Point, probable travel route

Table 17. Central Iowa Study Area composite spatial statistics

	DNSL	DNST	DFSL	DFST	DNGOSL	DNGOST	DFPL	DFPT
N. of cases	20	20	20	20	20	20	18	18
Minimum	0.052	0.052	0.113	0.113	0.254	0.254	0.065	0.065
Maximum	0.778	0.820	0.778	0.820	11.112	15.183	18.402	26.229
Range	0.726	0.768	0.665	0.707	10.858	14.929	18.337	26.164
Mean	0.287	0.304	0.421	0.443	1.527	1.883	4.556	7.317
Variance	0.048	0.060	0.045	0.051	5.945	11.267	21.515	47.634
Standard dev.	0.219	0.244	0.212	0.226	2.438	3.357	4.638	6.902

Key:

DNSL	Distance to Navigable Stream, linear measurement
DNST	Distance to Navigable Stream, probable travel route
DFSL	Distance to Feeder Stream, linear measurement
DFST	Distance to Feeder Stream, probable travel route
DNGOL	Distance to Nearest Great Oasis Site, linear measurement
DNGOT	Distance to Nearest Great Oasis Site, probable travel route
DFPL	Distance to Focal Point, linear measurement
DFPT	Distance to Focal Point, probable travel route

were available and used as a food source, although they played a relatively minor role. Regional estimates of elk populations are available from the time of Euro-American contact, but not for the localities. White-tailed deer populations can be modeled based on current carrying capacities of the study area which are 8-12 deer per square kilometer (20-30 deer per square mile). The minimum of 8 deer per square kilometer was selected to account for the lack of supplemental feed currently provided by agricultural fields.

a. *How do these theoretical cervid populations correlate with theoretical Great Oasis populations?* According to this study, based on localized hunting strategies and deer providing about 50% of the animal protein needs of the Great Oasis, deer populations are the single most important factor in estimating Great Oasis populations. If the conservative figure of 8 deer per square kilometer is accepted, a small village or hamlet of 23 to 41 people would need a site-catchment with a 3- to 4-kilometer radius, or between 28 and 50 square kilometers (Table 11).

5. *What are the population minimums and maximums of Great Oasis people in the study area and in each locality?* The Noah's Bottom locality catchment is approximately 120 square kilometers. Based on an estimate of 8 deer per square kilometer, the census of deer would be about 960 which could support 98 people at a sustainable level. If the estimate for the carrying capacity for deer were doubled, this locality could still support only about 200 people for a year. In the Lower South Raccoon River Valley locality, the catchment is approximately 100 square kilometers. The carrying capacity for deer is 800 for the locality which could sustainably support 82 people. Again, if the total deer population was doubled, the locality population would be about 164 people.

a. *Were there sufficient resources for the Great Oasis sites to be inhabited contemporaneously?* The analysis of the soils indicates there was enough cropland to support a rather large population. However, the faunal analysis based on archaeological and ethnographic parallels, indicates a much lower human carrying capacity due to the proposed Great Oasis reliance on white-tailed deer. In the final analysis, given small hamlets of approximately 30 people, only about 30% of the sites in a given

locality could be inhabited at any point in time without impacting their neighbors adversely. If the relative proportions of mammal (primarily deer) and aquatic food resources were adjusted upwards or downwards, the overall settlement system would not change appreciably.

6. *Can a predictive model be developed and tested with extant archaeological and site data (e.g., house types, terrace habitation zones, river bottom planting, floral and faunal inventories, lithics, ceramics upland mortuary practices, etc.) for Great Oasis settlements?* A Great Oasis settlement pattern can be predicted and tested. The procedure should begin with the basic known preferred landforms and soil resources within an identified Great Oasis locality or maximum of 11 kilometer from another confirmed Great Oasis site. These landforms would be high, intermediate-high, or intermediate Holocene terraces approximately 287 meters from a navigable stream. The preferred soil type for site location in Boone County is Moingona loam. The preferred soil types for site location in Dallas County are Wiota silt loam and Nodaway silt loam. The 1-kilometer radius site-catchment should have a minimum of 37 ha (93 acres) of potentially arable soil on the same side of the river as the site. Once a likely location has been found, pedestrian surveys should be conducted over recently disturbed soil to find diagnostic artifacts, primarily Great Oasis High Rim and Wedge Lip rim sherds. Other speculative artifacts would include polished celts, triangular projectile points, *Leptoxis* shell beads, and non-local cherts. A concentration of these artifacts would warrant subsurface testing and excavation. Expected faunal inventories would be varied but dominated by white-tailed deer remains. The archaeobotanical inventory would include native nut remains, maize, and *Chenopodium*. If

features are located, cache pits would be evident along with the post molds of a semi-subterranean pit house with a centrally located hearth and four-post superstructure.

### Conclusions

This study shows there is a consistent Great Oasis culture settlement pattern in the central Iowa study area. The Great Oasis people in this area were selective in choosing living sites that were near water and had sufficient amounts of productive soil suitable for agriculture. The distance between their sites is based primarily on the local carrying capacity of white-tailed deer (which appears to be their most preferred source of animal protein) and not being too distant from their neighbors to inhibit communication or common defense.

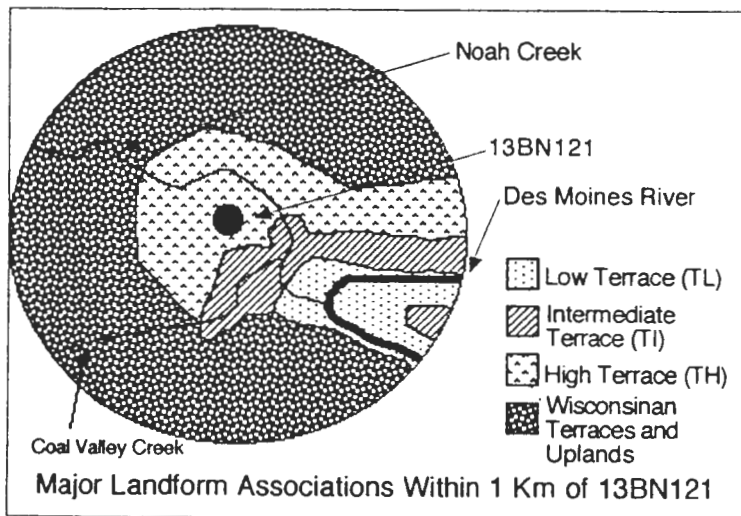
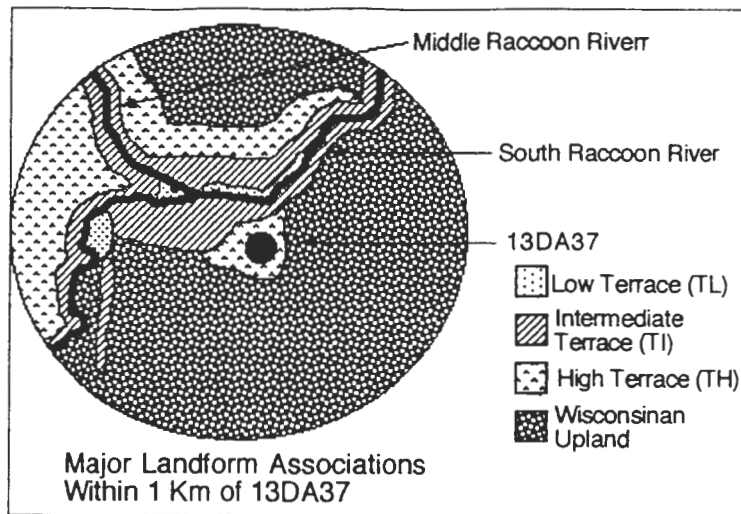
There are several issues that additional archaeological surveys and research may resolve. There are at least three Great Oasis sites in Webster County, Iowa. This may represent evidence of an entire Great Oasis locality upstream from Noah's Bottom. The Logansport site (13BN103) may not be the most northerly site in the Noah's Bottom locality because there are two large high terrace networks upstream, within 3 kilometers of Logansport on the east and west sides of the river. The reach of the South Raccoon River between the Harmon College site (13DA107) and Landis (13DA12) could be more extensively surveyed. In this area, 13DA33 is a probable Great Oasis site as well as 13DA40. More extensive surveys could be completed downstream from Landis to discover additional Great Oasis sites between the Middle Raccoon and the Des Moines River. Finally, surveys could be conducted in the vicinity of the West Des Moines burial (13PK38) to locate possible Great Oasis settlements and validate the existence of the hypothetical



Walnut Creek locality. Due to the disturbance resulting from modern urban expansion, there are few undisturbed landforms remaining in the Walnut Creek valley. Approximately 1 kilometer downslope from the West Des Moines burial is a terrace remnant in the turf parking lot of the Val Air Ballroom. This area would be a candidate for sub-surface testing and should be considered a priority for analysis due to the threat to local urban development.

## APPENDIX

## Site Locations Relative to Landform Associations



Examples of typical placement of Great Oasis habitation sites in relation to major landforms. (Upper box - 13DA37, Lower South Raccoon River Valley Locality, Dallas County, Iowa.) (Lower box - Sparks Site [13BN121], Noah's Bottom Locality, Boone County, Iowa.)

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